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NEW YORK, SATURDAY, AUGUST 5, 1899.

CONTENTS.

PAGE.

Editorial 185
Canadian Water Power Electric Plants—VI.; The Lachine Rapids, Montreal Transmission Plant, by E. M. Archibald..... 189
The Effect of Intense Cold on Magnetic Hysteresis, by Arthur H. Ford.... 195
Three-Phase Currents in the Manufacture of Calcium Carbide in Italy, by Cesare Pio 195
A Simple Device for Measuring the Frequency of an Alternating Current, by Hubert V. Carpenter 198
Economical Transmission and Distribution of Electricity from a Distance, by H. F. Parshall 200
Welding of Copper 200
The New Niagara Bridge 201
Electrical Standardization—V. 201
Current News and Notes..... 202

LETTERS TO THE EDITORS:

Prevention of Sparking on Breaking Circuit, by Charles G. Burke..... 205
Electrical Energy from Carbon, by Willard E. Case..... 205
Automatic Telegraphy, by J. Scribner..... 205
Digest of Current Electrical Literature, Compiled by Carl Hering..... 206
New Books 210
Electric Gas Lighting Attachments for Candle Burners..... 210
Electric Pumping Outfit..... 211
The "Petite" Alternating Current Enclosed Arc Lamp..... 211
Storage Battery Booster..... 212
The Riker Demi-Coach..... 212
Portable Lighting Outfit 212

DEPARTMENTS:

Financial Intelligence 213
Commercial Intelligence 213
Special Correspondence 215
General News 217
Personal 219
Trade and Industrial Notes..... 219
Record of Electrical Patents 220

INDICATION OF ALTERNATING CURRENT LINES.

In another column will be found a brief account of a recent patent on a beautiful method of indicating at any point along an alternating current line, the potential and phase angle of any point in the line without the use of pressure wires—the effect of resistance, inductance, capacity, leakage and load being accounted for. The method described is an extension of a previous one by the same inventor, which applied only to transmission lines and did not cover the case of leakage or distributed load; and this in turn appears to have been an extension of the original Shallenberger compensator which, we believe, only provided for the case of line resistance, or of resistance and line inductance without permitting the phase angle to be determined. As will be seen, the method consists in reproducing in miniature at the generating station or any desired point, the conditions of the line with respect to all of the factors affecting the potential and phase angle. That is, by means of an arrangement of resistances, inductances and condensers of small values, the main circuit is reproduced in miniature and consequently when subjected to an e. m. f. of corresponding proportions, the conditions at any point of that circuit may be indicated with respect to potential and phase angle by instruments located on the miniature circuit, the scales of such instruments giving readings in values of the main line.

SYNCHRONOUS VERSUS NON-SYNCHRONOUS MOTORS.

Each succeeding year brings synchronous and constant-speed motors into greater demand and preference over non-synchronous and inconstant-speed motors for those industrial operations that call for an unvarying mechanical process. A great number of mechanical processes call for a speed that is as nearly uniform as possible, and in some instances even small departures from uniformity of speed seriously affect the result of the work. For such purposes, the compound-wound direct-current motor and the synchronous alternating-current motor are much in demand. With these machines, so long as the generator can be regulated and the pressure in the mains sustained, the motors will maintain their speed within all normal loads. The synchronous motor has the additional advantage from the standpoint of the station manager that it takes but little wattless current and is therefore capable of being more economically operated than induction motors when the system is taxed by heavy loads. On the other hand, the synchronous motor is relatively weak in starting and requires its load to be applied after it has made a flying start. This can usually be arranged more readily on a large scale of power delivery than when small machines are operated. The general result is that induction motors are usually installed in small sizes and synchronous motors in large sizes.

MANUFACTURING IN ENGLAND.

The plans of American electrical manufacturers to establish themselves on English soil are naturally attracting a good deal of attention and eliciting a large amount of comment. The latest event of this character, the formation of the British Westinghouse Company, with large shops at Manchester, has served as a text for excited dis-

cussion in the daily papers, and we are sorry to see it hailed by some of the chauvinistic journals here as a distinct sign of Yankee supremacy in the manufacturing field and of English mechanical decadence. It is nothing of the kind, and while very encouraging to our status in the electrical arts, and creditable in other ways, it is in nowise a reflection on the skill and courage of our cousins. The capital enlisted is English, the directorate is English, and the labor will be English. In due time, as in the case of the old Brush Company in England, the designs may be radically modified and Anglicized. That America is to lead in much of the industrial advance of the times is evident, but they who assume that Europe is to be nothing but a "back number" forget England's ability to hold on and to learn in every line of trade, German leadership in many lines such as the chemical, and French ingenuity and artistic taste. Just as we have been leaders in many lines, so we have been very backward in others, such as automobilism.

It has already been predicted in these columns that when it came to heavy manufacturing, electrical apparatus would still be inevitably produced on the other side, and these events prove the forecast true. England is entering upon a career of electrical development that will tax to the uttermost all the old and new resources, besides leaving ample room for imports; and we believe that her wealth and density of population are going to do more for electric traction than is now deemed possible. The great trouble is going to come in finding the skilled labor. It must be drafted from other industries or from abroad. For example, it is stated that these big Westinghouse shops will employ 5000 hands. We doubt seriously whether there are many more than that all told now engaged in making dynamos and motors in England. Our English contemporaries while not alluding to this point, fear that the company may find the vagaries of the British workmen interfere with the admirable standard practice developed in America; and it is certain that upon this feature of these interesting new departures by this and kindred concerns from the United States, public attention in England will be intently fixed.

DISTRICT MESSENGERS.

It is with deep regret that a great many electrical people have seen the district messengers seized with the strike fever and indulging in violence and strong language with the object of securing better pay and more privileges. The messenger boy may serve as the butt of the comic paper and the comic paragraphs in the daily press, but he is fondly thought of by those who have long been intimately associated with him or who have risen from the Mercury ranks. Hence there is to be heard many a sigh of pity in his behalf and the expression of many a desire for his welfare. But the trouble is that the times are against him just as they are against the horse, and his sphere has become limited and circumscribed in a striking manner during the last few years. Relatively his numbers tend to decrease and the reasons are obvious. The telephone and pneumatic tube are not less his deadly enemies than are the trolley and the automobile, of the horse.

At the present time the daily telephone traffic in New York City is 300,000 messages a day. If put in the form of correspondence, this would mean the interchange of 600,000 letters daily, by mail or messenger. The average cost per telephone conversation may be put at a figure not to exceed 5 cents. Now it is certain that a messenger boy cannot go out on an average of sixty times a day. We believe fifty times is a good figure in practical work. Hence it would need 12,000 more boys to do the same work if the telephone did not exist. Allowing each boy 2½ cents per message on the average, he compares fairly well with the instrument, but then his cost to the public is not less than 15 cents, which would represent a cost of 30 cents for work that the telephone does for 5 cents. The average salary per boy runs, we believe, about $4.50 to $6 per week, which represents a good deal of telephoning. At 30 cents each, the daily telephone conversations numbering 300,000 would cost the New York public not less than $75,000 to $100,000 per day, whereas the actual cost, thanks to the telephone, runs probably much below $15,000 a day, and the cost is steadily lessened. It would probably not be easy to cut the wages of the boys any lower, but an attempt to increase them, in view of such a showing, is obviously likely to result in failure.

Of course the boys are useful outside carrying messages, and often serve as a supplementary express and parcel delivery system. But here again the mechanical tendencies of the times check that kind of usefulness. In Europe the use of the pneumatic system is well known in this direction, and already in this country steps are being taken to handle parcels pneumatically at a fraction of a cent per parcel where the actual cost is now over 5 cents. There is little doubt that this system will presently do much of the work now entrusted to district messengers at a high cost. And beyond that is the fact that automobile express wagons are going to enjoy a very large patronage at cheap prices for work beyond the capacity of the pneumatic system.

All this must modify the messenger service as it now exists. There may eventually again be more messengers, but there will be no "long hauls," and the service must be cheapened. If any of the studious boys should chance to see this, they may be helped to realize how serious is the problem now before their managers in finding employment for about 1700 of them in New York, and proportionately in other cities. They should also and always realize that the messenger service is a fine starting point in an honorable career and that many a well-known man has preceded them up the rungs of the ladder.

MAGNETISM AND MOLECULAR ROTATION.

The recent telegraphic announcement of Lord Kelvin, to the effect that "an electrified body is set in rotation by generation of a magnetic field around it," is of great interest and theoretical importance. Unfortunately, however, it does not appear to have been an experimentally observed fact, but only a theoretical deduction from already existing observed facts. The theorem appears to be based upon the well-known equivalence of electromechanical forces upon confined electric charges and electromotive forces upon free electricity. Thus, an electromotive force of one C. G. S. unit, or what Blondel would call a neovolt, is equivalent, along an electrically conducting path, to a dyne acting along an electrically non-conducting path. A neovolt will do as much work electrically upon a given quantity of electricity in a conducting path as a dyne will do mechanically upon an insulated body carrying the same quantity of electricity as a charge.

It is a familiar fact that the passage of a given number, say one million, webers of magnetic flux through a loop of wire generates in the loop an e. m. f. whose time-integral is one million neovolt-seconds. Consequently, if the loop be made of some non-conducting substance and charged with a unit of electricity, the passage of the magnetism through the loop will tend to push the electricity around the loop just as in the case of the conductor, and since the electric charge cannot move round the non-conducting ring, the ring must be urged round with a force whose time integral will be one million dyne-seconds. If the ring is free to move it must move under this impulse and continue to move until brought to rest by opposing forces. In the absence of friction or mechanical opposing forces, the rotation would continue until the magnetic flux was

withdrawn from the loop, when an electromechanical impulse would be delivered equal and opposite to the original impulse thereby arresting the motion.

The above reasoning leads to the following state of affairs: (1) The insertion of a magnetic pole into a conducting ring urges electricity around the ring. In the absence of frictional or opposing forces, the electricity would revolve around the ring until the magnetic pole was withdrawn. (2) The insertion of a magnetic pole into a non-conducting ring carrying an electric charge urges the ring bodily round. In the absence of frictional or opposing forces, the ring would revolve around the magnetic pole, until the latter was withdrawn. As a matter of fact, the quantity of electricity which can be imparted as a charge to an insulating ring is relatively very small, even when the greatest available electric pressures are employed. Consequently, the electromechanical forces that can be attained are relatively very small. Moreover, the electromechanical forces due to the electrostatic charge alone may be expected to mask the effect sought for. The effect seems to have been looked for unsuccessfully by more than one physicist.

A similar condition of affairs is presented in the theory of electric waves. According to this theory, every ray of light exerts a small mechanical pressure upon the surface it strikes. The effect is small, and when it is sought for by delicately suspending a vane in a vacuum tube, the electromechanical impact of a luminous ray is entirely masked by the thermomechanical forces brought into play, and which are utilized to produce the rapid rotation of a vane wheel in the Crookes radiometer. Lord Kelvin's telegram makes it appear that he considers this electromechanical effect of magnetism on a charge is capable of explaining the magneto-optical effects of Faraday, Kerr and Zeeman. If this is correct, a most important generalization will have been reached.

INTERIOR ALTERNATING CURRENT WIRING.

We receive occasionally a request for information concerning a simple method of calculating interior alternating current wiring which shall include the effect of inductance—the proviso being usually added that the method shall be within the range of the ordinary wireman. As is well known, the analytical calculation of inductance is far from simple, the equations involved being complex and laborious of solution. The graphical method of Mershon is, however, relatively simple, though even it can scarcely be said to comply with the condition noted. But is there any necessity for including the effect of inductance in calculating interior wiring, or is it commercially advisable to lower the impedance by decreasing the ohmic component—that is, by increasing the size of the wire—in order to only partially compensate for an inductive drop component which remains practically the same for the larger wire?

As to the first point, there can be no doubt as to the answer for wires up to at least No. 0 when the frequency is 60 periods per second. With a distance of three inches between centres, the impedance of a No. 0 wire with this periodicity exceeds the ohmic resistance by but 25 per cent.; or a drop of 2 volts with a direct current is increased to but 2½ volts with an alternating current having a periodicity of 60. For a periodicity of 130, approximately the same applies to a No. 3 wire, the drop in this case becoming 3 volts in a No. 1 wire. We may therefore conclude that inductive drop may practically be neglected up to No. 0 wire with a periodicity of 60, and up to No. 3 wire with a periodicity of 130, in the case of conductors whose centres are separated by three inches. When twin conductors are used, as when alternating current wires are carried in iron pipes, the small separation of the wires so reduces the inductive drop that it may be neglected for all B & S sizes of wire, and the same remark applies, of course, to concentric conductors.

Let us now take the case of a wire of such a size or separation of the two conductors, that with a large periodicity, its inductive drop cannot be neglected. To simplify consideration of the matter, we will assume a circuit 200 feet long of No. 0 wire carrying 75 amperes, the centres of conductors being separated by three inches and the frequency being 130 periods per second. The ohmic drop will thus be 3 volts, and by calculation the inductive drop will be found to be 4.85 volts, these quantities giving by vector addition a total drop or impedance of 5.46 volts. Suppose, now, in order to reduce the impedance, a No. 4-0 wire is used. Since the same current will be carried and the section of conductor is doubled, the ohmic resistance will be halved, and the inductive drop will be found by calculation to be 4.50 volts. By vector addition these components give a total drop or impedance of 4.74 volts. It will thus be seen that though the amount of copper is doubled, the impedance is only lowered from 5.46 to 4.74 volts, a difference of but .72 volts, or 13 per cent., though the ohmic resistance itself is reduced by 1½ volts, or 50 per cent. Were the wires separated a greater distance, the percentage difference would be still less for reasons given in a following paragraph. For example, were the distance between centres 18 inches, the drop in the No. 0 circuit would be 7.94 volts, and in the 4-0 circuit, 7.07 volts, or a difference of but 11 per cent.

Now suppose we employ two circuits of No. 3 wire, the double circuit thus having the same resistance as the No. 0 circuit since the cross-section of a No. 0 wire is twice that of a No. 3 wire. Since each No. 3 circuit will carry but half the current, the inductive drop will be almost halved, becoming 2.57 volts. As the ohmic drop remains 3 volts, the total drop therefore becomes 3.95 volts, or the drop by this means is reduced by 1.51 volts, and with but half the copper is .79 volt less than that of the 4-0 circuit. It will thus be seen that, leaving aside commercial considerations, the solution of reducing impedance drop does not lie in increasing the size of the wire, but in splitting the circuit into two or more parts. The question, however, is at the bottom a commercial one, and the answer to be given in any case will depend upon which method is in the end the cheaper.

It should be added that the split circuits should not be interlinked electrically. For example, if the two conductors of same sign were placed in contact (as might be done under the underwriters' rules, being of the same potential), the other two being also superimposed, or placed one on each side and separated the usual distance from the first mentioned, the drop would not be changed. It will be noted that though in the case of the 4-0 wire circuit the current remains the same as in the No. 0 circuit, the inductive drop is less with the larger wire, and since inductance is known to depend only upon the lines of force set up by the current flowing, at first sight this may appear puzzling. It is due, however, to the fact that the diameter of the large wire bears a considerable ratio to the width of the loop, and as the portion of the loop contained within the wire itself is subjected to less flux than the portion without, owing to the distribution of the current throughout the section of the wire, the drop becomes less for the same current as the wire is increased in diameter, the distance between the centres remaining the same. In other words, the self-inductance (or inductance for unit current) decreases as the wire grows in diameter. This, of course, is at variance with the idea that large inductive drops are the result of the use of large wires—the true condition being that large inductive drops are due to large currents, and large wires are used to carry such currents.

Dynamite Plot Against the Metropolitan Street Railway.

Evidence of a plot for the destruction of life and property by dynamite was discovered by the police late Friday night, July 28, through the arrest of Francis J. Curran, of No. 1843 First Avenue, New York City. Curran, a discharged employee of the Second Avenue electric road, is an ex-convict. A dynamite plant, ready for operation, was found in his rooms and a stick of dynamite specially prepared for use on a car track was taken from him at the time of his arrest. The appearance of two strange young men at his house Friday night and elaborate arrangements of clockwork and electric wires indicate a conspiracy involving several men. The police are satisfied that this plot was uncovered at almost the hour planned for its operation. Curran was caught after patient, searching investigation, which, it is alleged, proved that he was an agitator and a ringleader of strikers, bent upon revenge for alleged grievances. Investigation of the man's record showed him, it is said, to be a thoroughly desperate fellow, with a bad record.

The Trolley Riots in Corea.

A few weeks ago reference was made in these columns to the destruction of street cars and railway property in Seoul, Corea, by fanatical natives. In this connection an interesting letter from Mr. E. E. Rittenhouse, of Colorado Springs, Col., who was connected with the construction of the road, has been published. Mr. Rittenhouse tells how the howling mob around the power house was subdued. Mr. H. R. Bostwick, of San Francisco, manager of the Seoul Electric Company, and H. R. Krumm, of Columbus, Ohio, chief of the Imperial Engineering Department, by their coolness and nerve dispersed the mob of Orientals and saved their own lives and the power house. As the crowd gathered, the two Americans appeared on the scene and started across the open toward the mob. The effect was instantaneous. The sight of those two calm, fearless white men walking briskly into the very jaws of death, utterly ignoring the rage and wrath of thousands, paralyzed them with astonishment and awed them into silence. "Suddenly Bostwick held up his hand and commanded them to 'chorigah' (disperse) by order of the United States of America. He had hoped to impress them with a show of authority and parley until their ardor cooled down a little, but was hardly prepared for the stampede that followed the uplifting of his hand. Clubs and stones that were intended for these two brave Americans were dropped and the rioters simply climbed over each other to get away."

The Holland Submarine Boat.

The Holland submarine torpedo boat was tested in Peconic Bay, Long Island, last week, and it is stated that the results were satisfactory. The trials, which consisted of going under water for a mile, diving and coming to the surface for rapid observations, were given for the board of naval officers appointed to pass on the application of the Holland Torpedo Boat Company to change the motor power of the plunger when on the surface, or "awash," from steam to gas. It is stated that the vessel can be steered in any course by means of the compass, and that it is unnecessary to be able to see below the surface. The members of the board were apparently well satisfied.

American Automobiles Successful in France.

A special despatch of July 29 from Paris says: An interesting automobile race between electric carriages took place to-day, and brought out the good features of the American machines in a very gratifying manner. The race was called the Criterium des Electriques, and was organized by the paper *Sport Universel Illustre*. The course was from Porte Maillot to Poissy and back, a distance of about fifty kilometres. The entries were classified under three categories, viz., those weighing 1200 kilos and upward, those weighing 800 to 1000 kilos, and those weighing under 800 kilos. The only accident to be recorded was that to Heinz' carriage, which, slipping on a tram rail, swerved round against the sidewalk and broke a wheel. This was all the more regrettable since this particular carriage was the fastest one the Columbia company had entered. The Columbia carriage of G. Philippart won the race in one hour, twenty minutes and twenty-nine seconds, while M. Garcin was second in one hour, forty-eight minutes and ten seconds. M. Berg, in his Columbia voiturette, made the trip in one hour, fifty-three minutes and three seconds, thus coming in first in the voiturette class. The Columbia automobiles had Phœnix accumulators, the invention of M. Philippart.

Beating a French Express.

Two automobiles beat the Paris-St. Malo express in a race on July 30 between those cities, a distance of 226 miles, covering the distance in 7 hours and 35 minutes, and making the best time ever recorded for an automobile. The time of the train was 7 hours and 48 minutes.

The English Pacific Cable.

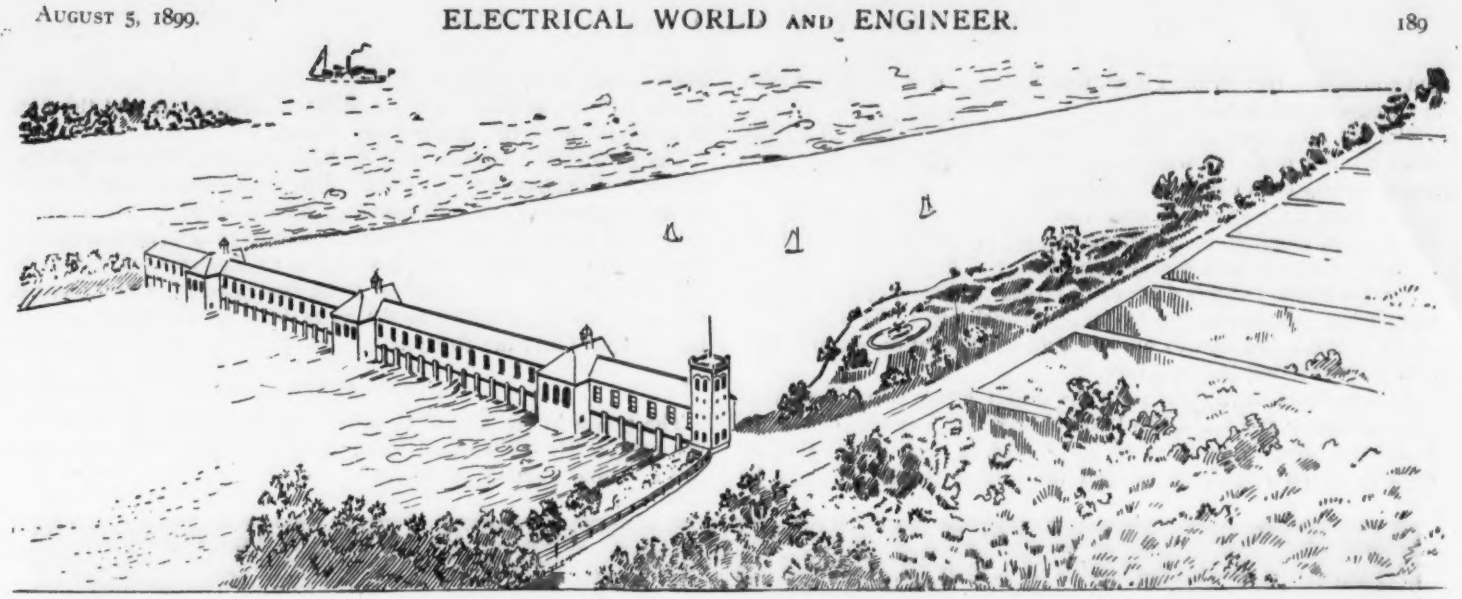
The bill providing for Canada's contribution towards the cost of the Pacific cable has passed the Dominion Parliament. The financial aspect of the undertaking is based upon the report of the imperial committee of 1897, which was favored with the advice of Lord Kelvin, the distinguished scientist. Their calculation was that the cable would cost in round figures £1,492,000. Since then an increase in the cost of cable material has brought the proposed cost up to £1,592,000. Sir Sandford Fleming has calculated that the cable would earn, with a due allowance for Asiatic business, in its first three years of operation, viz.: 1902, £114,157; in 1903, £153,031; in 1904, £192,375.

Bugs in Arc Lamps.

A peculiar incident is reported from Georgetown, British Guiana, where electric light has been recently introduced. The arc-light lamps, which apparently are not fitted with wire-gauze tops, became centres of attraction to a species of small beetle, which swarm in myriads along the coast and river shores at the beginning of the Guiana rainy season, and each lamp was speedily filled to the brim. The front ranks of the insects then came in contact with the current, which set their bodies on fire. The result was that the lamps were rendered useless for illuminating purposes, and the fumes from the burning insects floated into the neighboring houses, to the great annoyance of the inmates.

Motor Controllers.

On July 25 two United States patents were issued to Prof. S. H. Short on electric railway motor controllers, the first in date of application describing a device for transferring the arcing at the controlling fingers to another contact which is so constructed as not only to withstand the arcing to a considerable extent but to be capable of ready and economical renewal. The other patent has the same object in view, that of transferring the arcing from the controller cylinder, in this case to a separate cylinder with a large number of breaks in series. This latter device was used in a number of forms by the late Walker Company, particularly in the controller known as Type S, in which, assisted by a magnetic blowout, it proved very successful. Another patent granted on the same date is on a controller which is applicable more directly to elevator motors, the patentees being H. P. Davis and Gilbert Wright. It consists of a cylinder carrying a number of contacts to make the several usual connections with the motor, which cylinder is actuated in its motion by a strong spiral spring and controlled by a dash-pot device which is adjustable and which determines the speed at which the cylinder shall be revolved. The manipulator merely gives sufficient energy to the shaft of the controller to wind up the spring, and when a certain tension is attained, it is released and its torque, transmitted to the controller cylinder, moves it at a velocity governed by the dash-pot device. In this way the starting, stopping and reversing of the motor is within the control of the operator, but the speed of acceleration is entirely out of his control, thus rendering it possible for an inexperienced operator to start and stop the motor as economically as a trained expert.



Canadian Water Power Electrical Plants—VI.

THE LACHINE RAPIDS—MONTREAL TRANSMISSION PLANT.

By E. M. ARCHIBALD.

THE idea of developing the immense water power going to waste in the rapids of the St. Lawrence, at Lachine, is not new, for as early as 1868 a proposal was entertained to utilize the power for industrial purposes, but owing to financial and engineering difficulties it remained a proposal and nothing more.

Nothing was done until 1894, when initial steps were taken to harness the rapids, by the Lachine Rapids Hydraulic & Land Company, Limited, which was organized with a capital of $1,000,000 to sell the developed power to manufacturers who might be induced to locate there by reason of the advantages of cheap power, this being proposed to be supplied by means of a long jack-shaft.

Being unable to secure satisfactory terms for the disposal of the power by this method, the directors decided to convert it into electrical power and transmit to Montreal, a distance of some six miles. For this purpose an increase of capital was required, due to the extra cost of the electrical machinery, transmission line and city distribution, and this was accordingly increased to $2,000,000.

The undertaking was one of great difficulty; the river was first diverted from its course by erecting temporary coffer dams and then 250,000 cubic yards of rock were removed from the river bed. One of the most serious obstacles in their path was an immense reef of rock below the power house site which formed a natural dam, causing great trouble from backwater.

The question of frazil and anchor ice has always proved a veritable bugbear in the way of Canadian water power development. Frazil is formed in rapids or in rapidly flowing water, where surface ice cannot form, and consists of fine needle-like ice crystals becoming at times quite dense, even to the consistency of pea soup.

Anchor ice is formed on the rocky bed of an unfrozen stream by the ice adhering to the cold rocks, and building up greater and greater, produces an ice dam stopping the flow of the water. Any medium that will check radiation, such as surface ice, will tend to prevent the formation of anchor ice, as the temperature of the water under such ice, as is well known, is above the freezing point.

The plan by which the frazil and anchor ice were to be overcome consisted in having a large enclosed area of still water which would, of course, freeze over early in the winter, and as neither frazil nor anchor ice can form under such cover, that portion of the difficulty would be overcome.

The only remaining obstacle of importance was to get rid of the frazil ice which forms in the rapids above the enclosed area of still water. This was met by the fact that the natural current of the river, varying from 15 to 20 feet per second, would be deflected into the open river on meeting the frozen surface and would carry all frazil along with it.

HEAD RACE.

To obtain this body of still water, the actual velocity being only two feet per second, a head race was excavated 4000 feet long, about 1000 feet wide, the width varying with the river bank and 13 feet deep throughout. The river bed being of solid rock it became necessary to blast the greater part, the removed material being used in the construction of the wing dam separating the head race from the rapids outside.

The main dam has a concrete foundation one foot deep, 1000 feet long and 16 feet wide set in the bed rock. Resting on this foundation are the massive cut stone piers on which the power house stands, intersected by 43 flumes, each 40 feet long by 20 feet wide,

FIG. 1.—POWER HOUSE.

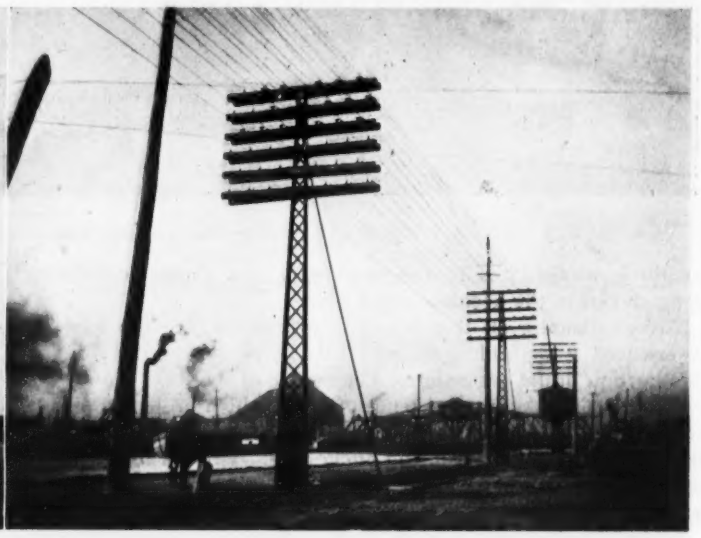


FIG. 2.—LINE, SHOWING TERMINAL POLE WHERE LINE ENTERS CONDUIT.

and containing two turbines each, with the exception of three, which are used as waste gates.

The tail race, 1400 feet wide, is ample for the disposal of all the water issuing from the wheels, the enormous reef previously mentioned having been completely removed.

The wing dam 5200 feet long and 1000 feet from the shore, to which it is parallel, is constructed of cribwork composed of 12" x 12" timbers faced with 3-inch plank and filled with rock.

A main boom extends diagonally across the entrance of the head race, being held in position by four cribwork piers. This serves as an ice breaker and also to prevent driftwood, floating ice and rubbish from entering the head race.

At a distance of 700 feet from the power house there is another diagonal boom and still a third boom, or rather a system of booms, is situated directly in front of the flumes in such a way that all rubbish which may have escaped the former is carried away by freeze over. Now suppose frazil does come, it must build up solid 50 feet before the head race is completely blocked up and the flow of water stopped; this is most improbable.

The backwater experienced last winter was caused by a combination of circumstances which need not be detailed here, but suffice it to say that the like has only occurred once in 42 years, the last time on record being in 1857. Notwithstanding, to prevent any future trouble from backwater, the tail race is to be extended and deepened; some three to four feet are to be excavated from the river bed and 1500 feet to be added to the wing dam, the extension projecting obliquely into the stream.

POWER HOUSE.

The power house, a steel building 1000 feet long by 40 feet wide, resting directly on the main dam, consists of three dynamo rooms and a similar number of turbine sheds.

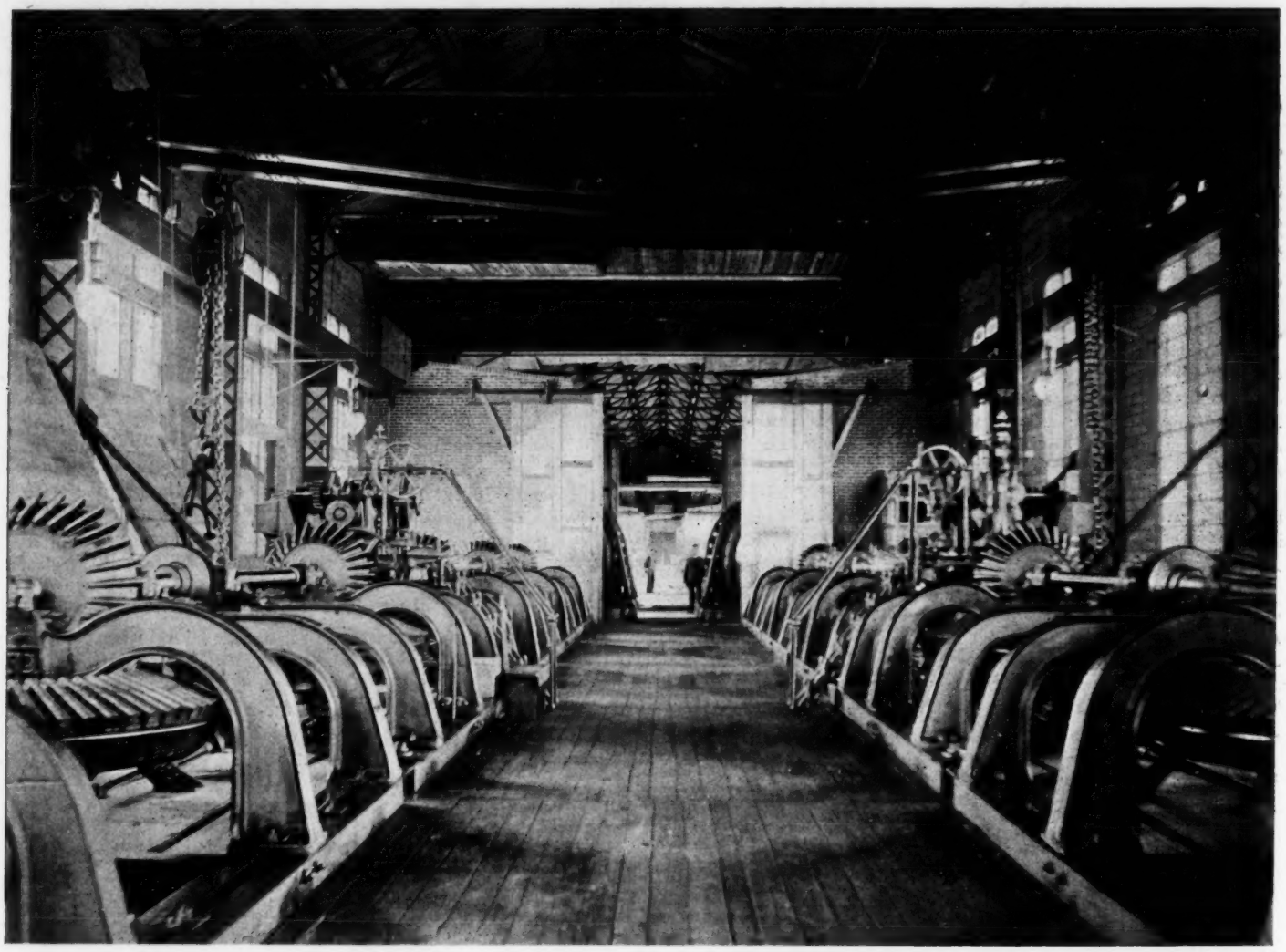


FIG. 3.—LOOKING ALONG THE TURBINE SHED.

the three waste gates in the main dam, the whole construction being shown in the accompanying plan.

Notwithstanding all this care and precaution, trouble has been experienced from both frazil and backwater during the most severe portion of the past winter. The cause of the frazil trouble was the previously unknown existence of a reef which projected past the wing dam and against which the frazil, in being swept onward with the current, adhered, producing anchor ice. This formed a natural dam, throwing the frazil into the head race instead of carrying it into the open channel beyond.

Work is now being carried on to extend the wing dam a distance of 1000 feet along this reef, in this way enclosing a greater body of water, and also erecting a massive pier, some 7000 feet above the power house, projecting 1000 feet from the river bank, thereby diverting the original course of the river and causing it to flow towards the main channel and away from the head race.

Again, from recent soundings a depth of 50 feet has been discovered above the present head race, which is only 13 feet deep, and this will be included in the new head race and will, of course,

The dynamo rooms, each 65 feet long by 45 feet broad, are constructed of brick, the steel roof being supported by steel columns, and situated equally distant along the dam, separated by a brick wall from the turbine sheds, but being wider than the remainder of the building project slightly on both sides. The floor is of concrete covered with 1½" slate, the whole being supported by steel I-beams.

The turbine sheds have a steel framework covered with two thicknesses of grooved and tongued boards on which three-ply enameled felt is placed and over all No. 20 corrugated iron, giving the building the appearance of stone at a distance. The floor here is 3" plank resting on steel I-beams. The roof is of asphalt.

At the shore end of the power house there is a square brick tower, the first floor of which contains the offices of the operating staff, while in the second the line fuse blocks and lightning arresters are situated, and from which the wires pass from the building to the transmission line carrying light and power to Montreal some six miles distant.

A balcony extending the entire length of the upper side of the

power house provides a beautiful promenade and affords a magnificent view of the rapids outside the wing dam.

The dynamo houses and all the offices of the company are heated electrically by electric heaters placed in unobtrusive positions on the walls and manufactured by the Dominion Electric Heating & Supply Company, of Ottawa, Ont.

The hydraulic equipment consists of 72 58-inch "Victor" turbines of the vertical type, 48 of which are at present installed, each being capable of developing 215-hp at 69 r. p. m. under the normal head of 11 feet, while with the abnormally low head of 8 feet these wheels will develop 135-hp each. Such a head has occurred but once since the inception of the plant, which was last winter when the backwater was produced, as previously mentioned.

These wheels are connected in a series of six and transmit their power by means of heavy mortise bevel gearing and jack-shafting to the direct connected generator in the dynamo house, there being one generator to each set of six turbines. The speed is regulated by a Geisler electro-mechanical governor, situated immediately over the jack-shaft, operating the cylindrical wheel gates of each wheel by means of a system of gearing and electromagnets engaging one of two friction clutches, the whole being balanced by a counterpoise on each wheel.

gallons a minute at 150 pounds pressure, the two being capable of pumping over 2,000,000 gallons a day; they were built by the Goulds Manufacturing Company, of Seneca Falls.

For handling and shifting the machinery a 25-ton electric crane runs the entire length of the building.

The electrical equipment consists of twelve 750-kw three-phase Canadian General Electric generators and exciters, the total generator output being 12,000-hp. Only four of these are in operation at present, although four more are now being installed in dynamo room No. 2, and the remainder will be placed in position as soon as required. These generators are each unitooth, 40 polar, operating at 180 r. p. m., having revolving fields and stationary armature and wound to deliver 99 amperes with a frequency of 60 cycles per second at 4400 volts directly to the transmission lines, no interposition of step-up transformers being needed. The frequency of 60 was selected as being most suitable for both light and power and not too high to seriously increase the line impedance. Each generator is rigidly connected to its jack-shaft.

The iron in these machines is worked on the straight part of the magnetization curve, such that by increasing the field excitation very slightly, the machine voltage is greatly increased; this is preferable for long distance transmissions as the voltage may at any time be

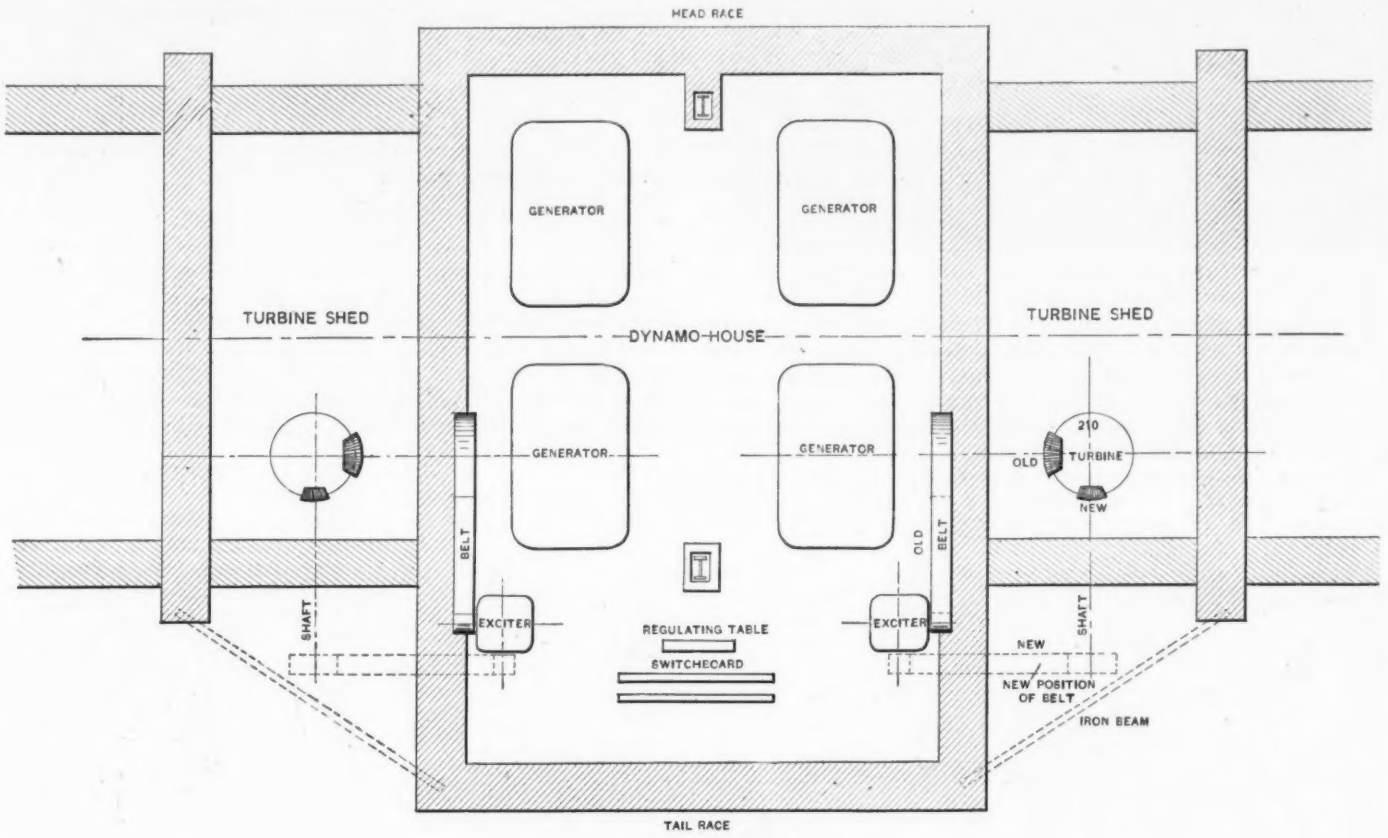


FIG. 4.—PLAN OF DYNAMO ROOM.

The concrete flumes in which these wheels operate are each 40 feet long by 20 feet wide, and contain two wheels. Iron head gates are placed at the entrance, to cut off the water supply in case of necessity, while directly in front of these are iron racks for preventing debris and floating matter from being drawn into the wheels.

The hydraulic equipment, including wheels, governors, gearing, shafting, jokes and girders, was manufactured and installed by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

For fire protection and also for the water supply of the proposed model town to be erected on the company's property in the neighborhood, there are two triplex pumps installed, each placed between two lines of shafting and connected to either by a friction coupling, such that either or both may be put in operation from either shaft at any time. To each pump there are two pipes leading from the head race to draw water, two discharge pipes into the tail race and two relief valves, and they are so constructed that they may continue operating even though one-third is out of order. A complete system of piping extends over the whole power house, provided with hydrants placed in convenient positions so that fire protection is amply secured. Each pump has a capacity of 1000 easily raised to overcome the heavy line drop due to large loads being applied suddenly.

The six Canadian General Electric exciters, that being the ultimate number, are four polar, 75-kw, 150-volt, direct-current, compound-wound machines, operated at 660 r. p. m., each from an independent turbine having an independent water wheel governor.

The turbine used for this purpose is one of the six 215-hp wheels for operating the generators, the last wheel of the series having been detached from the generator shaft (Fig. 4), and is belted to one exciter, a small addition to the original building having been built to admit of this arrangement. This permits of operating any of the four generators in each dynamo room, each exciter being sufficient to operate the whole four machines, if necessary, and this also secures much closer regulation than when the exciters were belted to one of the generators as was formerly the case.

SWITCHBOARDS.

There are three main switchboards, situated one in each dynamo room, only one of which is fully installed. Each switchboard controls four generators and two exciters and consists of seven highly polished marble panels mounted on an angle iron frame.

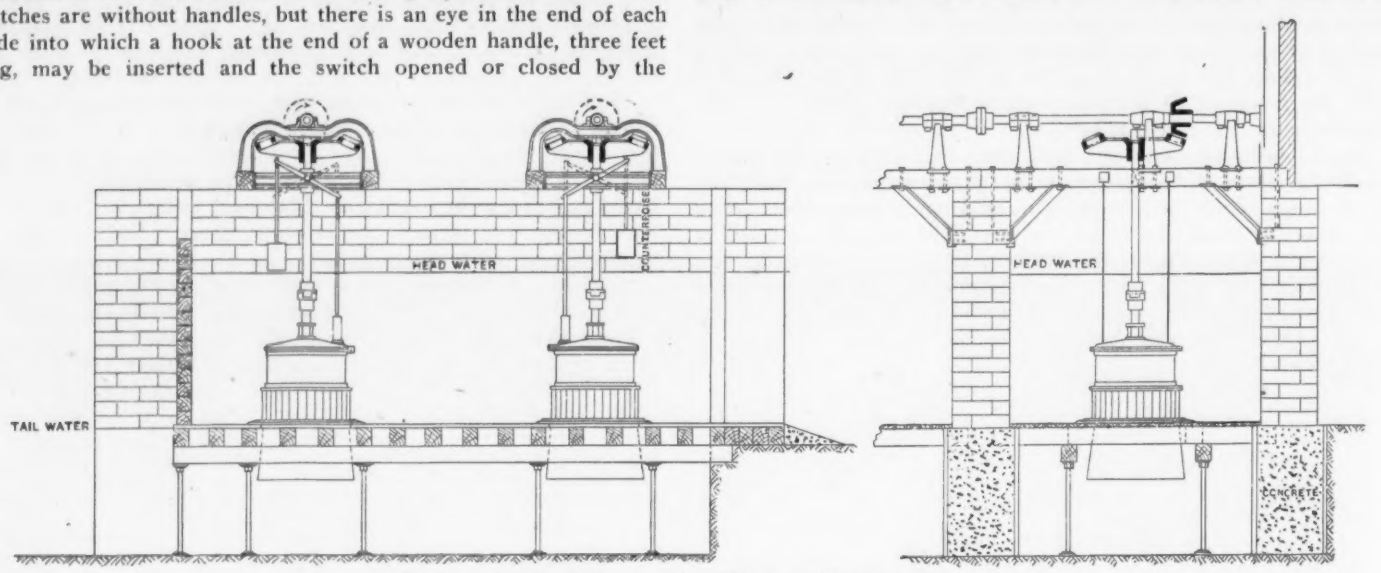
The two outer panels, one at each end, are for light and power, there being two separate sets of bus bars for this purpose insulated with heavy rubber and tested to 10,000 volts. These panels each contain four instruments—three ammeters, one for each phase, and a direct reading voltmeter—all of the Wagner horizontal scale type with illumined dial; three single blade, double-throw, quick-break, high-tension line switches and two static ground detectors. These switches are without handles, but there is an eye in the end of each blade into which a hook at the end of a wooden handle, three feet long, may be inserted and the switch opened or closed by the switchboard attendant at a safe distance. To prevent arcing from blade to blade, heavy marble barriers are interposed between each switch. The switches are double-throw so that any line may be connected to either the light or the power bus bars.

The next two panels on each side are for the four generators, and each contain the three synchronizing lamps, two ammeters and the field switch. Synchronizing the alternators is performed somewhat similar to the German system described in these columns some time previous, but was designed by the engineers of the plant and has been in use some 18 months. In this system the machines are in step when the upper lamp is dark and the two lower ones are of an equal incandescence. The ammeters are of the Wagner horizontal scale type with illumined dial. The field switch is of the horizontal double-pole double-throw type, so as to be able to excite the fields from either of the exciters, and is such that on opening, the field circuit of the generator is short circuited and the disruptive discharge is harmless.

The remaining panel, the centre one, controls the two exciters and contains three Weston direct-current instruments—two ammeters, one for each exciter, and a voltmeter which may be used for both machines by means of a switch placed below; two alternating current voltmeters, of the Wagner type to read the line and generator voltages, the correct reading being obtained by multiplying by the ratio of transformation of the voltmeter transformers placed on the back of the board; and two triple-pole double-throw switches, of which the third pole is the equalizer connection, and double-throw to permit of two different voltages being used, one from each exciter, in case the power generator, for instance, should require a greater field excitation than the others.

All high tension fuses are situated at the back of the board and near the top, so that in case of a fuse blowing, no damage is done either to the board and apparatus or to the attendant. These fuse blocks are of the snap break expulsion type, the fuse being aluminum placed between two vertical wooden blocks. The whole fuse block is inserted in the line simply by pushing two blade-like copper contacts between two clips placed on the corrugated hard rubber pyramids, the clips being connected to the line by solid copper rods, as seen in the accompanying illustration.

On viewing the back of the board we find it divided into two



FIGS. 5 AND 6.—SIDE AND END VIEWS OF TURBINE PIT.

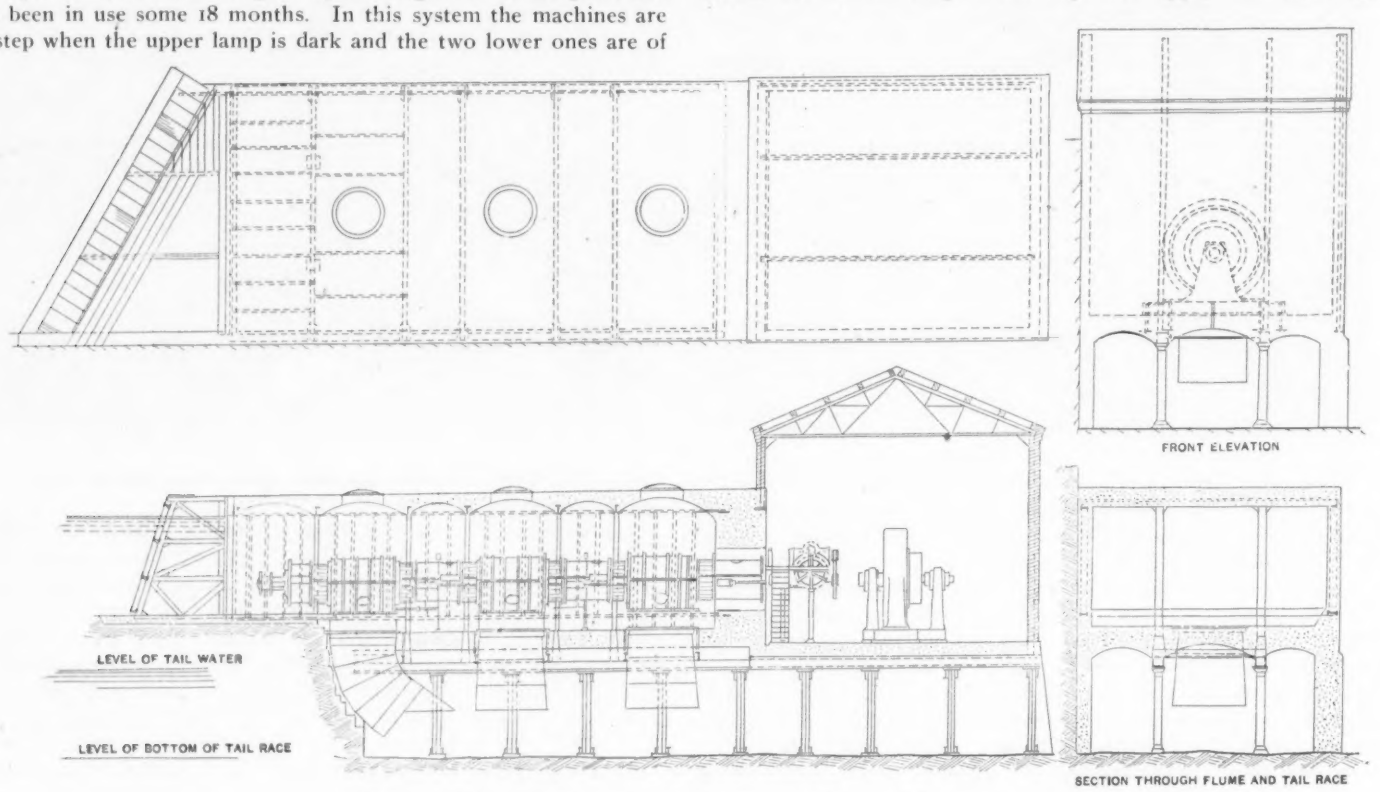


FIG. 7.—PLAN, ELEVATION AND SECTIONS OF POWER HOUSE.

parts, the first containing only the bus bars with their many connections and the instruments wires; the second, in the rear, a skeleton board constructed of hard wood well shellaced and japanned, containing only the voltmeter and synchronizing transformers. Between the switchboard and the wall there is a space of about seven feet, thus eliminating the danger of contact with the switchboard.

Situated directly in front and about 4 feet away from the switchboard is a marble table on which are placed the signaling apparatus by which the switchboard attendant can give or receive any signal necessary between the switchboard and the turbine sheds. The regulating devices consist of the four field rheostat handles, the exciter rheostats, the synchronizing switch and the four small switches for operating the emergency switches of the oil type worked by

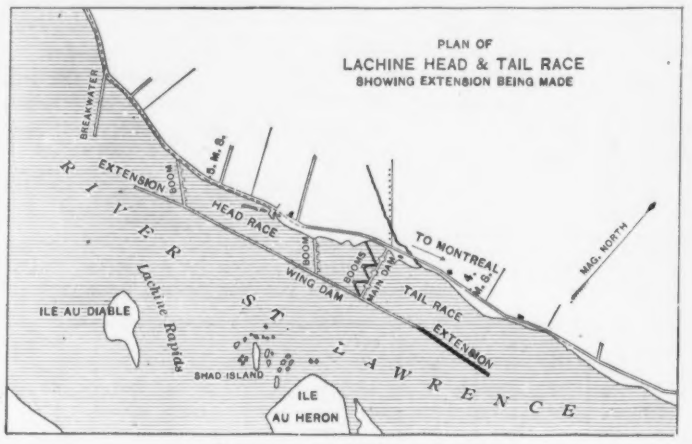


FIG. 8.—MAP OF LACHINE RAPIDS.

compressed air and placed one in each generator lead in the basement below the switchboard. These switches will be used altogether, with the exception that, in the event of their getting out of order, they may be rapidly disconnected and the generators can then be handled by means of the knife switches on the face of the board.

This idea of controlling the entire equipment at a safe distance free from danger is an excellent one, as the high tension is wholly separate from the low-tension apparatus; this system was specially designed by Mr. R. S. Kelsch, the general superintendent. As an extra precaution a large rubber mat is placed on the floor extending the entire length of the switchboard.

Directly in front of this regulating table there is a steel I-beam supporting the roof. Here are placed the three switchboards containing guages for recording the levels of the head and tail races, recording voltmeters for the exciters and for the lighting and power line, the switches for regulating the lighting in the building, for the control of the water wheel governors, for the electric heaters, electric crane, motor driven air compressor, for the fire alarm signaling system and emergency calls.

From the machines paper covered lead armored cables containing the three wires conveying the three-phase current are carried to the switchboard, thence on stone piers along sills on the lower side of the power house to the tower or terminal house in fireproof conduits, whereby means of a switchboard any generator may be connected on any line. Thence it passes to the line through fuses, taps being taken off each line to Wirt's short gap lightning arresters.

Choke coils are not used, as it seems to be an open question whether they are not more disastrous than none at all during a lightning discharge by greatly increasing the potential on the generator side of the line. In any case, it is very probable that only one coil on a machine would be punctured and these are very easily replaced on this type of generators.

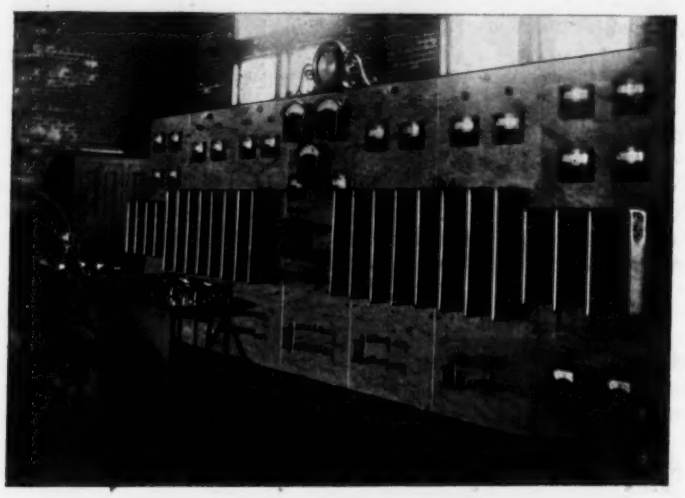


FIG. 9.—MAIN SWITCHBOARD AND REGULATING TABLE.

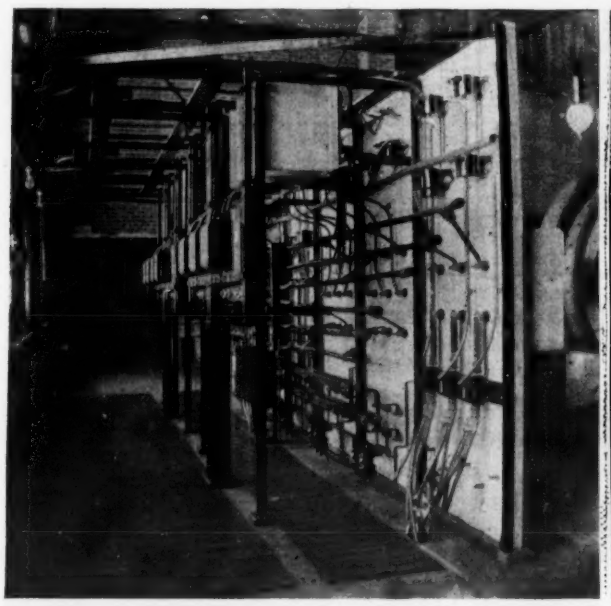


FIG. 10.—REAR VIEW OF SWITCHBOARD.

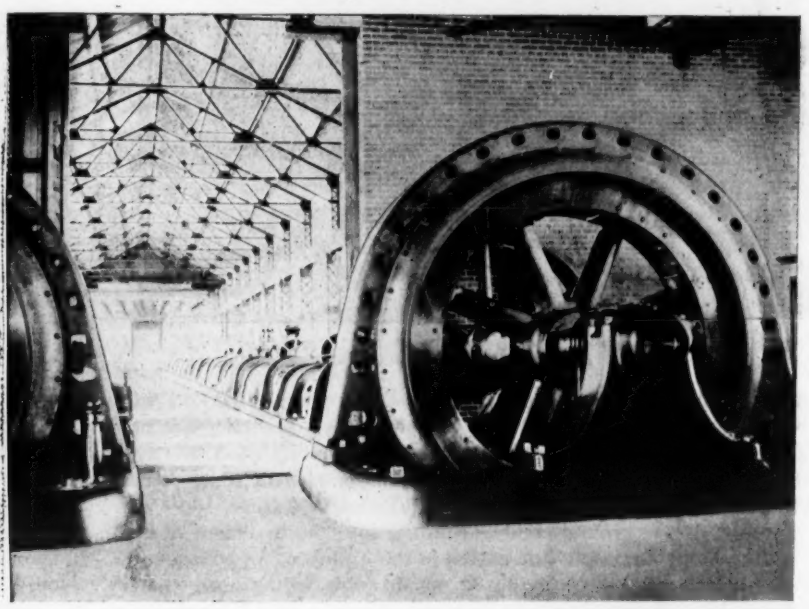


FIG. 11.—ONE OF THE 750-KW THREE-PHASE GENERATORS.

POLE LINE.

The pole line, starting from the power house, traverses the company's property until the Lachine Canal is reached, which it then follows until well into Montreal, when it passes underground to the substation. To this point where it enters its subterranean chamber it is 30,000 feet long. The poles are of latticed iron 35 feet long, imbedded 6 ft. in concrete, the foundation being 2′x3′, and are spaced 100 feet apart.

Each pole has a capacity of 12 three-phase circuits consisting of 36 wires, the three wires of each circuit being placed in the triangular form 18 inches apart and spiraled to prevent mutual induction. The line drop is 14 per cent. at full load. Though the cross-arms are of wood, as a safety precaution every pole contains the notice in English and French "Do Not Touch."

The line is No. 0 B. & S. medium drawn bare copper wire, two

circuits of which are securely fastened to ordinary Western Union double petticoat deep grooved insulators, and in the two years of operation not the slightest trouble has been experienced, while the heavy triple petticoated white porcelain insulators to which the remaining four circuits are attached prove too strong a temptation for the small boy with his handy stone, and consequently many are broken. For this reason glass will be used hereafter.

An ordinary galvanized iron barbed wire grounded at frequent intervals runs the entire length of the line over the three-phase wires, and this, together with the lightning arresters at each end of the line, secures protection against lightning.

To secure uninterrupted service and to accommodate the remaining circuits, another pole line will be erected some 200 feet distant from the present one, everything being similar except that the poles will be of white cedar 50 feet long, 8 inches in diameter at the top and spaced 100 feet apart.

At the termination of the pole line, there is a terminal house, a view of this being shown, where the wires converge into a paper covered lead armored cable, one circuit in each, the insulation being 7-32" and tested to withstand 15,000 volts, made by the National Conduit & Cable Company, of New York. At this point they dip down and pass underground, crossing 10 feet below the bed of the Lachine Canal in 3" cement lined iron pipes, of which there are 24, and thence to the substation not far distant.

SUBSTATION.

The substation, a two-story brick structure situated at the corner of McCord and Seminary Streets, contains the engineering offices besides the step-down apparatus. Everything in this substation is temporary work, as it was considered better to delay putting in the

FIG. 12.—SUBSTATION IN MONTREAL.

fixtures until the most improved methods had come out. This will probably be done next summer, as the plans are now being laid out and the construction and installation will be rapidly pushed. The temporary work in itself is very substantial; indeed in some places it might be considered so much so as to remain a fixture.

From the underground conduit running into the basement of this building the transmission line passes to the high-tension board, consisting of marble panels mounted on an angle iron frame. After passing through the aluminum line fuse it reaches the high-tension switches, which are similar to those used in the power house, heavy marble barriers being interposed to prevent an arc jumping across from blade to blade; thence to the step-down transformers, of which there are six 250-kw of the Wagner self-cooling type, immersed in mineral oil in an upright corrugated iron cylinder, the voltage here being reduced to 2400. The transformers are protected on both the primary and secondary sides by enclosed fuses.

The temporary secondary switchboard is of hard wood well shellaced, and contains the usual ammeters and voltmeters for the primary distribution, these being of the Wagner type similar to those used in the power house and high-tension switches for controlling the reduced voltage and have asbestos covered wooden barriers to prevent the arc from jumping across.

From here the primary distribution is carried over the entire city in underground conduits containing fom 8 to 63 ducts of 3" cement-lined iron pipe, some 450,000 feet of this being laid, in which three-phase wires varying from No. 3 to 0000 B. & S. are placed, each in a paper insulated lead armored cable of which some 100,000 feet are already in use, all manufactured by the National Conduit & Cable Company, of New York.

The manholes in the street, varying in size from 6 feet by 8 feet to 10 feet by 10 feet, are each covered with a heavy iron cover. Ventilation is maintained by running pipes to the street poles, the usual method by perforating the covers being prohibitory on account of the severeness of the winters, which would not only freeze up all the perforations but also cover it with a thick layer of snow; every manhole is connected to the sewer to dispose of the drainage.

Cables are carried above ground from these conduits for the ordinary overhead distribution, to feed areas of half a mile radius. Should one cable fail in any manner the remaining cables will carry the extra load temporarily.

To ascertain if this underground system was causing electrolysis, a test was made and in some places the cables were found to be positive to the ground, but this was remedied by connecting a heavy wire from the armor of all the cables to the street railway ground return, at a point where the conduit passed near that sta-

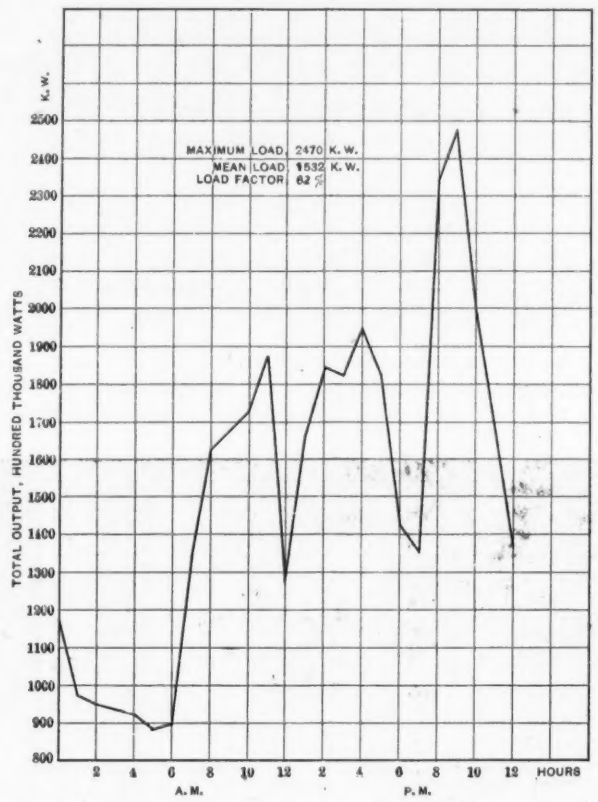


FIG. 13.—LOAD CURVE, JULY 7, 1899.

tion, and also by connecting all the armor together at each manhole. At a second test every part of the cable was found negative to the ground.

AUXILIARY PLANT.

To avoid any possibility of the ice question being not satisfactorily settled and to ensure uninterrupted service to the many customers, a steam plant is being placed in position at two of the small substations, each of which were previously operated by steam and under the management of two distinct companies, their franchise and equipment having been purchased by the present company.

An addition of 2000-hp is being made to the 500-hp already in use at the Chenneville Street station, situated in the very centre of the city, and 1000-hp is being placed in the substation at Cote St. Paul, one of the suburbs of Montreal.

In the former station, the equipment will consist of a battery of Babcock & Wilcox water tube boilers, Westinghouse engines and General Electric rotary converters of 400-kw each. These latter are ordinarily used to supply direct-current to some customers in that

district, being operated by the alternating current from the power house, but may, in the event of trouble, be belted to the engines and act as double current generators delivering direct-current as usual, and also delivering alternating current to the main substation.

In the latter station, in Cote St. Paul, the equipment will consist of Manning boilers, Westinghouse engines, two Walker and two General Electric synchronous motors, usually to operate three 125 light Wood arc machines, which are at present run from the jackshaft in the power house, to light the streets of Westmount, one of the Western suburbs of Montreal. In case of trouble at the power house the engines will operate the whole installation, the synchronous motors then acting as generators supplying current to the main substation.

In Montreal power and light are both used from the same circuits on this company's lines, but in the near future this will be changed to two separate circuits for the main districts, one circuit, however, supplying both the light and power in the scattered portions.

The average summer day load is some 1500-kw, which at night is increased to 2500-kw, while the winter load runs as high as 4000-kw.

The rate for lighting is for ordinary service, ¾ of a cent per 16-cp lamp-hour, with a discount of 20 per cent. for prompt payment. For large consumers under contract the rate is reduced to ½ cent per lamp-hour; this corresponds to 9.4 and 7.8 cents per kw-hour respectively, four watt lamps being used. When the separate power and light circuits are connected up these will be replaced by 3.1 watt lamps.

The rate for power varies from $85 per horse-power per year for small units to $32 per horse-power for large machines, the largest units on the line being a 100-hp three-phase induction motor operating at 550 volts, and a 200-hp synchronous motor operated at 4000 volts direct from the line.

The hydraulic equipment for this great undertaking was designed by W. McLea Walbank and T. Pringle & Son. The complete hydraulic and mechanical equipment was installed by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio; the electrical equipment by the Canadian General Electric Company; Peterboro, Ont., all the details having been designed by R. S. Kelsch, the electrical engineer.

To W. McLea Walbank, managing director of the Lachine Rapids Hydraulic & Land Company; to R. S. Kelsch, electrical engineer and general superintendent; to A. Mauschel, power house superintendent, and to I. R. Taylor, of the engineering staff, I am much indebted for material assistance rendered in the preparation of this article.

The Effect of Intense Cold on Magnetic Hysteresis.

By Arthur H. Ford.

While investigating the effect of annealing on the hysteresis loss of thin sheet iron, the writer tried the effect of intense cold on this loss with such interesting results that they are thought worthy of publication.

The iron was such as is used in transformer cores and was .0142" x ⅝" x 3", enough strips being put together to make a bundle .1" thick. The percentage of impurities contained was silicon .02, phosphorous .076, manganese .29, sulphur .03 and carbon .10. The specimens were cooled by placing them in a beaker of liquid air and their hysteresis loss was measured with a Ewing hysteresis tester, first while cold, and afterward, when they had attained the temperature of the room. To insure accuracy four specimens were tested and their mean hysteresis loss taken. The loss expressed in ergs per cycle per cu. cm. at a density of one gauss, was as follows:

Initial	.00124	% increase.
Cold	.00159	28
After warming	.00139	12

The loss after warming was the same for three of the specimens.

An increase in the hysteresis loss while the specimens were cold was to be expected from the change in this loss with temperature, at higher temperatures; but according to our usual conception of the stability of iron at ordinary temperatures one would hardly expect a permanent increase in the hysteresis loss. Might not this phenomenon be due to a change in the molecular structure due to the intense cold?

Some other samples of the same kind of iron showed the following effect of heat treatment:

		Hysteresis loss.
Annealed from	835° C	.00140
Quenched in water from	225° C	.00125
Quenched in water from	400° C	.00145
Quenched in water from	804° C	.00150

The samples used for showing the effect of cold on the hysteresis loss had not been annealed since the sheet was rolled.

The temperature of iron at a red heat is 600° C and that of liquid air is — 210° C.

Three-Phase Currents in the Manufacture of Calcium Carbide in Italy.

By Cesare Pio.

THE calcium carbide industry has been largely developed in Italy since 1896, in which year the commercial use of acetylene became general in that country. After the construction of the factory of Pont San Martin near Ivrea (Piemonte), which utilizes water power, many other companies were formed and electric furnaces installed where it was possible to obtain power from water falls. In 1897 the Societa Italiana dei Forni Elettrici, of Rome, installed a factory at Narni; a little later the Societa Italiana pel Carburo de Calcio, Gas Acetilene ed Altri Gas, capitalized at 3,000,000 francs, installed a 3000-hp plant near the Marmore Falls Terni. In the month of August of the same year a company was formed in Turin, and electric furnaces were installed in San Marcello d'Aosta, utilizing the power of the Dora Baltea. This company owns the patents of Mr. Riccardo Memmo, a young electrical engineer who has made a lengthy study of the question of electric furnaces with a view to their operation by three-phase currents.

Although the plant of San Marcello d'Aosta is of only small capacity (800-hp), and has not therefore a great industrial importance, I think it will be interesting to give here some details relating to it, owing to the use of three-phase currents in the furnaces. Another feature of interest in this plant is that transformers are not employed in the transmission of power. I am indebted to Mr. E. Segre, chief engineer of the plant, for the data I give on the construction and operation of the furnaces.

The reaction in the formation of calcic carbide is expressed by the formula, $CaO + 3C = CaC_2 + CO$. As is known, all the carbon does not combine with the calcium, an atom combining with the oxygen to form carbon monoxide. There is, therefore, a loss of material and the production of a waste gas. Experiments and tests made at the temperature obtained in ordinary furnaces (about 1500 degrees C.), show a residium which contains traces of calcium carbide and which is not practically useful; but at temperatures of the electric furnace estimated between 3000 and 4000 degrees, the reaction takes place fairly well, there being little loss and the carbide is almost pure in quality.

Instead of lime, calcium carbonate (marble) may be utilized, but this substitution is not to be recommended since it greatly increases the volume of the material necessary, and also of the gas developed during the reaction.

In calcic carbide factories the carbon is usually received in the form of coke. The San Marcello works, however, being situated near the great forests of the Alps, it has been found more profitable to use charcoal. The wood is transformed into charcoal in gas retorts and the gas liberated is utilized to heat the furnaces used in baking the lime and the lime and carbon mixture. The charcoal and lime prepared in this manner are separately pulverized and then mixed in the right proportion, using a little water and some tar. A machine completes the mixture and cuts the composition into irregular bricks. As these bricks contain a considerable amount of water, they are dried in a baking furnace heated by the gas coming from the electric furnaces.

As this preliminary preparation takes a long time, it may at first sight seem superfluous. In fact, in calcic carbide factories it is usual to merely make an intimate mixture of the two components in the form of powder, which is then used directly in the electric furnace. But the process of forming the powder into bricks, compressed or not, has certain advantages. By this system the loss is avoided of a considerable amount of the components, which are carried off mechanically by the furnace gases. Besides, the use of dust in the furnace gives rise to arcs of irregular form and very hard to con-

trol. The baking of the bricks is necessary to avoid the production of steam, which would cool the furnace and otherwise give trouble. Moreover, the quantity of carbon otherwise wasted would be considerable, especially on account of the porosity of the charcoal.

The plant of San Marcello at present utilizes 800-hp from the falls of the Dora Baltea River, but in a short time extensions will be finished, and then the plant will have a capacity three times greater than at present. Horizontal turbines, each developing 400-hp at 200 r. p. m., drive, by means of rope, four Oerlikon 150-kw three-phase alternators. The shafts of the turbines are on the same axial line, and they may be coupled together by an elastic coupler. Four fly-wheels of 15 feet diameter on the turbine shafts have each seven grooves in the peripheral face, for as many cotton ropes for the transmission drive.

The three-phase alternators were especially designed for this class of work. The armature is of the drum type and revolving, and the field has four poles. The normal speed is 480 r. p. m., the frequency is 16 cycles, and the capacity is 600 amperes at 146 volts. Exciting current is supplied by an independent exciter provided with a switchboard containing a circuit breaker, ammeter, voltmeter and field rheostat. In each alternator field circuit is a resistance which may be controlled with great nicety. There is also an arrangement whereby the field current may not be broken without first throwing in the whole resistance. The alternators are connected together mechanically and electrically, two by two. Whenever one of the alternators of a group needs repairing, it is possible to run the other one alone.

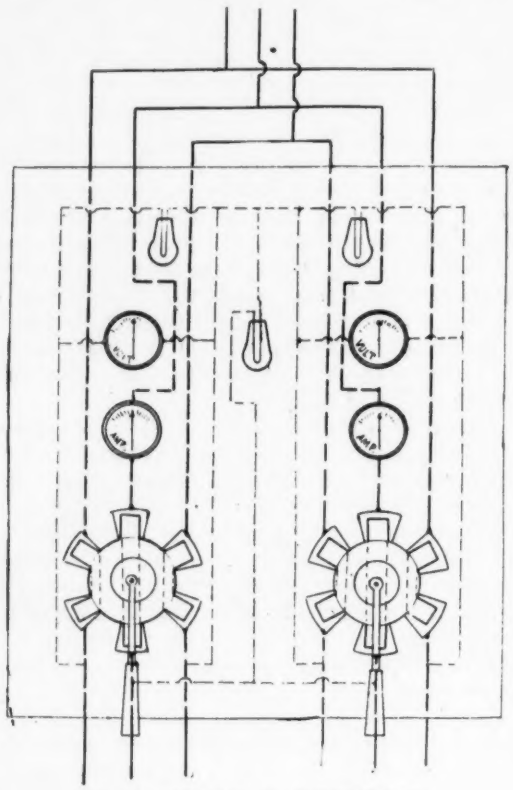


FIG. 1.—DIAGRAM OF CONNECTIONS.

Each pair of alternators has a main switchboard panel, on which are assembled all the apparatus for control and synchronizing. Each panel has two ammeters, two voltmeters and two three-phase switches. The switches are of special design and in one of their two positions, as the diagram of the connections (in Fig. 1) clearly shows, the alternators are connected in multiple. The voltmeters are of the hot-wire type and they may be connected with any of the phases.

There are two pilot lamps for each alternator, connected across the leads for control of the voltage, and a third lamp is used for synchronizing. Since the alternators are mechanically coupled, a synchronizing lamp seems superfluous, but this arrangement was provided to avoid a considerable difference of potential between the leads. In this latter case the synchronizing lamp will blow and the switchboard attendant thus be notified of the trouble.

The ammeters are permanently in series with only one of the leads of each machine; this disposition is, of course, defective, for if it happens that one of the other phases is cut out at the furnace, the ammeter will not indicate the fact, and the switchboard attendant cannot judge of the work developed by the machine.

The panels are of white marble and from them the mains go to the furnace room, where there is another switchboard for the control of the furnace operation. On this switchboard are two 1200-ampere switches and three ammeters. The conductors are for 600 amperes, and made of twelve copper cables, tape insulated. The insulators of these conductors are made of paraffined wooden blocks surrounded by an iron ribbon tightened with a bolt. The insulator holder may be attached to the walls or to the ceiling. The ends of the mains coming from the alternators are soldered to the cable terminals in the usual way (Fig. 2), but the ends going to the furnaces have a special joint made with hard solder, since the heat conducted from the furnace in addition to the C^2R heating would melt the ordinary solder. The cables in proximity to the furnaces are asbestos insulated.

Electric furnaces are of two types—resistance furnaces and the arc furnaces. At San Farcello the arc type has been adopted. The arc is produced in a furnace either between a carbon block and a receptacle containing the material to be treated, or between the carbons. The heating produces the combinations required. Direct or alternating current may be used.

Mr. Memmo, the engineer who installed and manages the plant, considers it more advantageous to use three-phase than single-phase alternating currents. There are therefore three arcs instead of one in the furnace, and the heating surface is thus larger and more uniform. The arcs may be developed either in triangle between the carbons, or in stars between the carbons and a conductive plate acting like the neutral point of the alternators. The control of furnaces using three-phase currents is very much simpler than in the case of other kinds, since for any reason should one of the arcs blow out, the furnace will still operate on the other two arcs, and the strain on the alternators due to sudden changes of load is thus avoided.

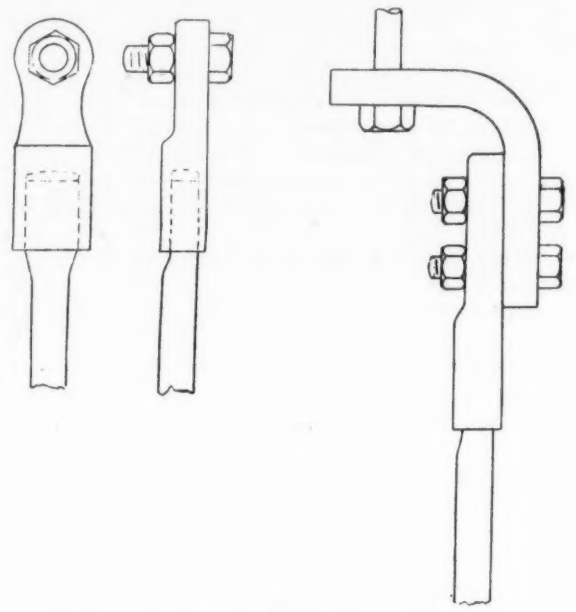


FIG. 2.—CABLE TERMINALS.

At San Marcello there are two different types of three-phase furnaces—continuous operation furnaces patented by Mr. Memmo, and furnaces operating intermittently. Fig. 3 shows the general features of the first type. It is cylindrical in shape and made of refractory bricks. The three carbons are inclined and controlled by three threaded rods operated each by a small wheel.

For filling the furnace a metallic funnel is provided on top. A cast iron plate covered with several layers of graphite may be lowered or raised the whole height of the furnace by means of a screw moved by a gear and pinion operated by a small wheel. In filling the furnace, the material falls down between the carbons, the carbide is formed and the plate is slowly lowered. After six or seven hours of work, the plate is at the bottom and it is possible to take off the carbide already cooled by a door provided at the lower part of the furnace. The furnace may therefore work without intermission.

The current during operation is controlled by lowering or raising

the cast iron plate, and the carbons are moved only when necessary to supply the loss caused by their consumption.

The intermittently working three-phase furnace, Fig. 4, is of the greatest simplicity and resembles in appearance the Willson furnace. Externally it has the shape of a cubical block, and the internal capacity is about seventy cubic feet. The walls inside are made of refractory bricks and the outside of ordinary bricks. The bottom of the furnace, which is in contact with the melted carbide, is made of compressed bricks of magnesium oxide, or consists simply of a strata of lime.

The front door of the furnace is of masonry reinforced by an iron back, and is capable of being securely fixed to the furnace wall by means of iron bars. The furnace is covered by a refractory brick vault, in which there are three holes for the three carbons. The front wall above the door has a hole provided with a cast iron pipe for filling the furnace while in operation. On the rear wall there is another hole similarly situated for the exit of the gas produced. The gas may either be burned at the hole, and the products led away through a flue, or after washing in water tanks, may be conducted to the baking furnaces and there burned.

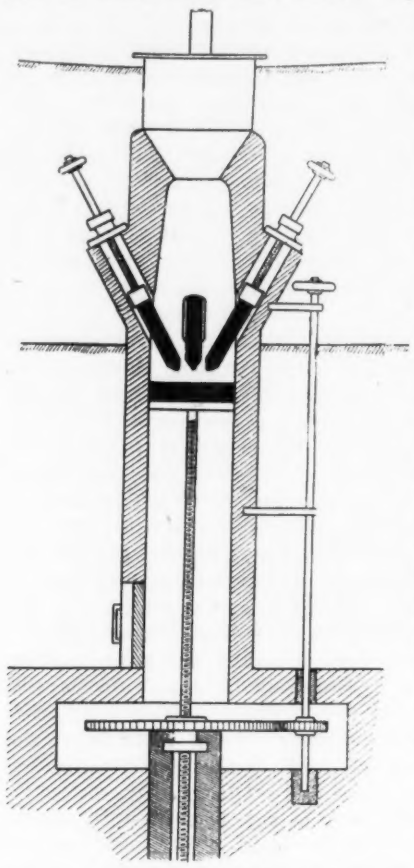


FIG. 3.—CONTINUOUS OPERATION CARBIDE FURNACE.

The carbons are 5 inches in diameter and held in a metallic carbon holder secured to a large iron rod which conducts the current and controls the position of the carbons. The iron rod is threaded its whole length, and screws up and down in a bronze collar supported by a cast iron plate considerably larger than the hole in the vault of the furnace. By turning the cylinder by means of a small wheel, it is possible to raise or lower the carbons in the furnace. The control by this system is of great sensibility. It avoids all sudden movements of the carbons, and makes it possible to gradually lower the carbons as the operation of the furnaces requires. The leads are connected by bolts to the cast iron plates. To lighten the weight on the vault which, on account of the heating of the furnaces, softens, the plates are supported by iron rods from the walls.

The attachment of the carbons to the iron rod is the matter which gave the most trouble. Generally the holder is a hollow cylinder of iron or copper, the inside diameter being exactly the same as that of the carbon. It may be in one piece with the iron bar, but more frequently it is screwed to the bar. To hold the carbon, either grooves are cut in it or the shape of the end is made conical. Fig. 5 shows different types of carbons.

The falling of the carbons was an accident which happened frequently during the first experiments. Since there are always some air gaps between the carbons and the holders, arcs formed which burned the metal and ruined the screw fastening the carbon. Moreover, since the expansion of iron by heat is so much greater than the expansion of carbon, when red hot the iron no longer makes good contact with the carbon thus giving rise to the formation of arcs. To avoid these troubles, the carbon and iron are heated at the temperature at which they are to be used before the former is entered. Such spaces as remain are filled with a mixture of graphite and glue. In this manner, the trouble above described is avoided.

Sometimes it happens that after being used the carbon holder is found burned on the bottom, probably by arcs between two carbon holders or between one of the carbon holders and the carbide when the carbon is mostly used. It is therefore advisable to change the carbons before they are entirely burned, and to avoid during the operation lowering one carbon more than another.

The arcs when the furnace door is open make a noise similar to that of a steam engine, and the light of the arcs should not be observed from a near distance. When the door is shut the noise is less perceptible. In beginning the operation, the carbons are lowered to the bottom of the furnace, resting on a block of graphite or of carbide in order to be short circuited at starting, the mixture of carbon and lime being an insulator. Then the furnace is filled with bricks of the mixture. The internal dimensions of the furnace being considerable, there is always about a half inch of material next to the walls which remains unchanged. It is good practice not to remove this material because it avoids excessive heating of the walls and does not allow the melted carbide to adhere thereto. When the furnace is filled, the masonry door is shut and the fissures are filled with clay or lime. The filling pipe is closed with a metallic cover, which acts also like a safety valve as the waste gas filled with dust has a tendency to explode.

The carbons being short circuited, the switches are thrown and the alternators started. When at normal speed, the resistances in the armature circuit are gradually cut off. The speed then drops and there is danger that the alternators may break down if the action of the turbine regulators is not quick enough, or when the water is not sufficient. When all the resistance is cut out the normal current ought to be 1200 amperes per leg at 145 volts. To regulate to this current, the furnace attendants raise the carbons by means

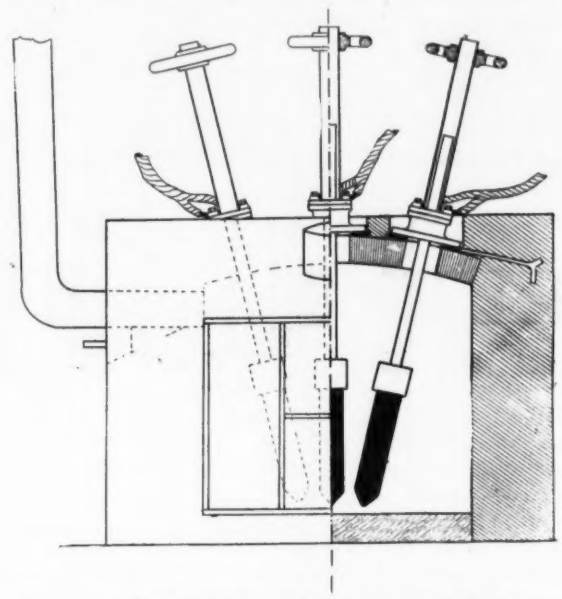


FIG. 4.—INTERMITTENT-OPERATION CARBIDE FURNACE.

of the wheels until the current has its normal value. It sometimes happens that one leg gives more current than the others, owing to unequal distances between the carbons, but the tendency disappears as soon as the first quantity of carbide is produced.

At the beginning, a great deal of white vapor is produced consisting of steam and volatilized lime; after one or two minutes the reaction begins and the gas is composed mainly of carbon oxide. When the carbon oxide is not utilized in the baking furnaces, it is good practice to burn it before sending it off, as this prevents the dangerous gas from accumulating in the upper part of the building.

During the first ten minutes of the operation, the air contained in the furnace and that entering through fissures it is impossible to close entirely, produces with the gas small explosions in the interior of the furnace. These explosions, which are not dangerous, do not occur when the furnace is heated, as then the pressure inside is greater than outside. After twenty or thirty minutes of work the furnace may be filled from the main door. This filling is necessary, for the volume of the material decreases notably on account of the loss of gas and the density of the carbide being greater than that of the mixture. The ammeter readings give a good indication as to when further material is required. When filling of the furnace begins, the current drops, and consequently the voltage rises rapidly on account of the poor conductivity of the mixture. The furnace attendants must always watch the ammeters.

Trouble comes frequently from the interruption of the current in the furnace. If this happens in only one of the phases, the consequences are not serious because it lasts but a short time; but some-

times it happens that the three arcs go out at the same time, either because the carbons have been raised too quickly or because of the formation of a vault which, falling suddenly, will break all three arcs. The machine running then at no load increases in speed rapidly, the voltage rises before the turbine regulator can work, and the lamps of the switchboard blow. It often happens that while the speed is high the arcs form again, and the current then is so intense that the fuses blow.

The furnace is filled every fifteen minutes, it being necessary to keep it entirely full. To discharge the furnace it is necessary to stop the production. Each operation lasts from four to five hours.

In regard to efficiency, it would be more convenient to work more than five hours as the production of carbide is larger during the last moments and there would not be so great a loss of heat and usage of electrodes. But the troubles which occur after five hours of work are too frequent, and besides, the quantity of gas produced is so considerable that it is not possible to breathe near the furnace. To stop the operation, the alternator field is cut off, and the cables are taken out and connected to the next furnace, which has been made ready.

Before discharging the furnace it is necessary to wait some hours to enable the carbide to solidify, as it would be dangerous to remove the door before. Even after five hours the blocks of carbide are red hot, but the external surface is solidified and it is possible

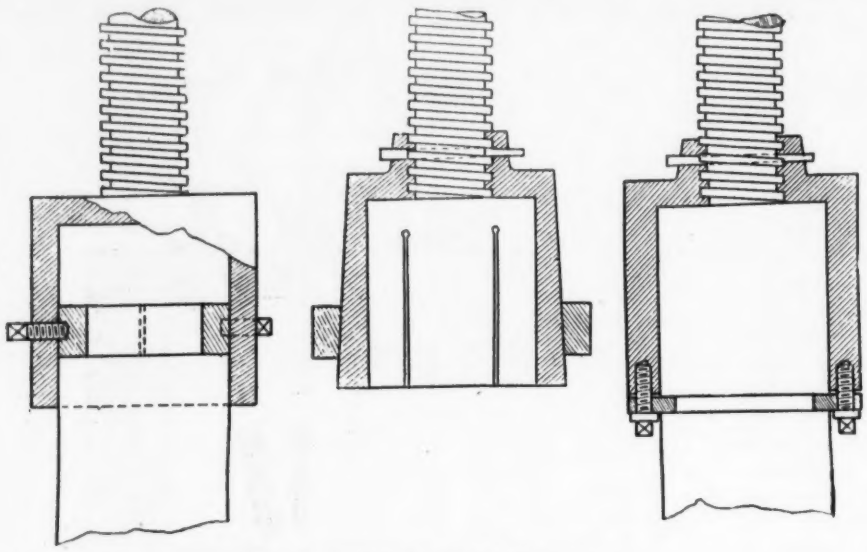


FIG. 5.—TYPES OF CARBIDE ELECTRODES.

to remove the blocks with iron rods. The blocks weigh 300 to 500 pounds and require many hours to cool after they are taken from the furnace. It is not advisable to break the uncooled blocks, as hot carbide readily oxidizes. When the blocks are of good quality they are very hard to break.

There are three different kinds of carbide corresponding to different portions of the blocks. The carbide on the exterior of the block has the appearance of graphite. Inside, it has a gray color, and is partly crystalline. In the central portion of the block the carbide is crystalline and has a red copper color. This last kind has the best efficiency for the production of acetylene.

Concerning the cost of production of carbide, Pictet calculates that one horse-power may produce in twenty-four hours about eight pounds of pure carbide. Willson claims that results obtained at Spray show it is possible to produce 11 pounds per daily horse-power. The results obtained at San Marcello check with theory, and with the production of factories elsewhere in Europe. On an average the San Marcello factory for every four hours with 300 horse-power, produces 360 pounds of pure carbide, or 2160 pounds in twenty-fours, or 7.2 pounds per horse-power-day.

As to the carbon electrodes, during one operation of four hours the total consumption is 10 to 12 pounds, corresponding to $6.00 per ton of carbide produced. This cost is very high and it is very likely that furnaces working continuously will decrease this figure, as it is principally at the frequent stops that the carbons are consumed.

WIRELESS TELEGRAPHY AND BALLOONS.—Experiments are being conducted in England in the use of balloons in exploding mines and magazines by electric waves. It is stated that the experiments in this direction are eminently successful.

A Simple Device for Measuring the Frequency of an Alternating Current.

BY HUBERT V. CARPENTER.

THE problem of measuring the frequency of an alternating current is one which has many possible solutions. A suitable method, however, must be simple, free from diseases, independent of temperature and air pressure; and should possess a degree of accuracy limited only by the variability of the source of current. It should also be adapted to easy and rapid determinations.

In laboratory work or testing where the generator is at hand, the most common method is to calculate the frequency from the speed of the generator as given by the tachometer or the revolution counter. The only advantage of this method is that no special apparatus is required. It is not only inaccurate but slow and clumsy. A synchronous motor has been introduced in order to apply the above method in cases where the generator was at some remote point. A hot wire instrument depending upon the heating due to hysteresis in a hard steel wire has been used. The steel wire is made the core of a long coil which carries the current. The absorption of energy and the consequent rise in temperature increases directly with the frequency or number of reversals of magnetism per second, so the elongation due to heating can be used to indicate the frequency. The calibration of this instrument is, however, quite difficult and may easily become inaccurate after a time. The wire must be carefully shielded from air currents and the readings require correction for variations in the room temperature.

A vibrating steel reed projecting over the poles of an alternating current magnet has been made to work successfully. Its natural period is brought into resonance with that of the current by changing the length of the vibrating portion until the vibration reaches a maximum amplitude. It is independent of surrounding conditions, but it requires careful calibration, and the length of the vibrating reed must be determined very accurately. A modification of this method was given by Kinsley in the *Physical Review* for April, 1899, which seems to be a great improvement. Instead of changing the length of the reed itself, a movable non-magnetic rider is attached to the reed and the position of this rider determines the natural period of the reed. If the period has been determined for two positions of the rider, the period corresponding to any other position can be calculated from a formula. Kinsley has also developed another method which depends upon the use of a resonant air column. This, however, gives readings which must be corrected for temperature, and certain other slight corrections are neglected.

The method to be given in this article is that of a stretched wire vibrating in synchronism with the current. This is not by any means a new idea, but it seems to have been considered a poor method by those who have mentioned it. Careful tests show that such is not the case; in fact, it seems to come nearer to fulfilling all of the requirements than any of the devices given.

There are three ways of producing the vibrations in the wire. First, place the centre of the stretched segment of a soft steel or iron wire over the pole of a soft-cored electro-magnet which is energized by the alternating current. Since the wire will be attracted by the flow of current in either direction through the magnet, the frequency of the wire's vibration will be twice that of the current. The lengths given in the following table must be divided by two or the stretching weights multiplied by four if this arrangement is used. Second, if the soft core be replaced by a permanent magnet which has a permanent strength about equal to that induced in it by the maximum current in the coil, the current will double its strength, approximately, when flowing in one direction and neutralize it in the other, thus producing an attractive force on the wire which varies in cycles of the same frequency as the current itself. This requires only one-fourth of the tension for a given length and frequency as in the first method, and the experiments seemed to show that it is slightly more sensitive. The magnet used as the core of the alternating current electromagnet should be made of a bundle of magnetized wires to prevent eddy current losses, since there will be some heating due to hysteresis which is unavoidable.

Third, the use of some other metal than iron or steel for the vibrating wire prevents change due to corrosion but requires a new plan for producing the vibration. This can be done by placing the centre of the vibrating segment between the poles of a permanent magnet and passing the alternating current through the vibrating wire itself. Each impulse of current will cause the wire to cut across the field in a direction which reverses with the current. The frequency of the vibration thus set up will be the same as that of the current as in the second method just given.

With a proper current strength the vibrations produced in the wire by any of these methods become of visible magnitude only when the natural period of the wire is nearly equal to that of the current so that the successive impulses may have a cumulative effect. This condition is reached by varying the length of the vibrating segment.

If it were necessary to calibrate the wire as in the other methods, its utility would rank but little above them, but this is not the case. A stretched wire has been shown, both theoretically and by experiment, to follow very accurately the law expressed by the formula

$$n = \frac{1}{2l}\sqrt{\frac{F}{W}}.$$

Where:— n = number of vibrations per second;

l = length of vibrating wire;

F = force in dynes with which the wire is stretched;

W = weight of wire in grams per centimetre length.

If we arrange the instrument so that the tension, F, is produced by a weight, the value of F is given by this weight in grams multiplied by the acceleration due to gravity which varies from 980 to 981 in this country. With F determined in this manner, there is no factor in the right-hand member of the equation which cannot be determined with the greatest accuracy in the laboratory, and within the limit necessary for this work almost anywhere.

Evidently then we must look to the practical application for errors. The question arises as to the accuracy with which the length of the wire can be adjusted to make its natural period equal to that of the current. Experiments to answer this show that the length can be set for a frequency of 60 with a probable error of less than ⅓ of 1 per cent. Any slight error in the length can be detected by the beats, or periodic variations in the amplitude of vibration, of the wire, which can be seen when each beat is several seconds in duration. The correct length is known by the disappearance of the beats, and an increase in the amplitude of vibration.

Another chance for error lies in the fact that the tension, F, on the wire may not be exactly that which the suspended weight would indicate owing to friction at the stop which limits the vibrating segment. This can be avoided easily by proper design. Changes of temperature and air pressure have no measurable effect upon the results, so we see that the results obtainable should be quite accurate. Experiment shows that with a constant source of current results can easily be obtained within ¼ of 1 per cent. Since the speed of very few alternators is regulated within 1 per cent., even on steady load, the requirement for accuracy is satisfied.

In practice, with a frequency of 60 the wire was so stretched as to have a natural frequency of 60 when the length of the vibrating segment was 60 cm. Then a change of one cycle per second in frequency corresponded very closely with a change of 1 cm. in length of the wire. This is shown by the following table, based upon the condition that when the wire is 60 cm. long its frequency is also 60:—

Length.	Frequency.
58 cm.	62.08
59 "	61.017
60 "	60.
61 "	59.016
62 "	58.06

As an example of the calculations, let us take the case of a steel piano wire which weights .00785 grams per centimetre of length. What weight will need to be used to stretch it so that a segment of it 60 cm. long will vibrate with a natural frequency of 60? The formula being $n = \frac{1}{2l}\sqrt{\frac{F}{W}}$, if $n = 60$, $l = 60$, $W = .00785$ and $F = w \times g$ where w is the stretching weight in grams and g is the acceleration due to gravity; g is equal to about 980.6 in Central Illinois, so if we substitute these values we have,

$$60 = \frac{1}{2 \times 60}\sqrt{\frac{w \times 980.6}{.00785}}$$

$w = 414.99$, or practically 415.0 grams.

Assuming lengths of 60,62.5 and 66.5 centimetres for the wire, the accompanying table gives the weights necessary to stretch various kinds and sizes of wires to the proper tension to make their natural frequency of 60, 125 and 133.

For 125 and 133 cycles the weights are given which make $l = 62.5$ and 66.5 cm. respectively, so that a change of 0.5 cm. indicates a change of one cycle very closely.

If English units of length and weight are preferable, the formula becomes— $n = \frac{9.824}{l\,(\text{inches})}\sqrt{\frac{\text{oz. (tension)}}{\text{oz. per in length.}}}$;

30 inches, 31¼ inches and 33¼ inches are good lengths to use for the three frequencies mentioned because a change of ½-inch in the first and of ¼-inch in the last two corresponds closely to a change of one cycle per second in frequency.

As an example, let us take the same wire as used in the first problem—diameter = .0141 inches, weight per inch = .0007034 oz. Find the stretching weight for a length of 30 inches and a frequency of 60 cycles per second.

$$n = \frac{9.824}{l}\sqrt{\frac{w}{W}}$$

$$n = 60 \quad l = 30 \quad W = .0007034$$

$$w = \frac{n^2 l^2 w}{9.824^2} = \frac{60.^2 \times 30.^2 \times .0007034}{9.824^2} = 23.671 \text{ oz.}$$

It will be noticed that the weight varies directly as the weight of the wire per unit length, and also directly as the square of the frequency and as the square of the length of the vibrating segment. This reduces the work necessary to get the result under different conditions to a very simple calculation.

WEIGHT AND TENSION OF WIRES.

Wire.				Stretching Weights in Grams and Ounces.					
				$n = 60$ $l = 60$ Cm.		$n = 125$ $l = 62.5$ Cm.		$n = 133$ $l = 66.5$	
Gauge No.	Diam. in Cm.	Material.	Grams per Cm. Length.	Grams.	Ounces.	Grams.	Ounces.	Grams.	Ounces.
	.150	Steel piano wire.	0.138	7295.3	257.34	34355.	1211.9	44030.	1553.1
	.036	" " "	0.00785	414.995	14.638	1954.3	68.940	2504.8	88.360
	.046	Phosphor bronze.	0.0143	756.0	26.668	3560.3	125.59	4563.4	160.97
20 B & S.	.0812	Copper.	.0460	2431.8	85.780	11452.	403.98	14977.	517.70

Cable For Colombia.

The government of Colombia has granted to a foreign company the right to lay and work a submarine telegraph cable between the port of Rio Hacha, Department of Magdalena, and Colon, connecting with the ports of Santa Marta, Colombia and Cartagena. All these ports are on the Atlantic side. The company binds itself to open the cable to public service within eighteen months from the date of approval of the said contract. The government reserves the right of censorship over messages sent by the line in time of war, and it is further stipulated that, pursuant to the laws of the country, only Colombian courts shall have jurisdiction over questions arising between the government and the concessionaire. It is believed that a large market for submarine cable in connecting up the Atlantic and Pacific coast lines of South America still exists. As in Cuba, the roads are often very bad and cross mountainous country, rendering sea communication inevitable. A South American with his family reached New York last week, finding the trip here the shortest way of getting across four or five hundred miles of Andean mountains.

Economical Transmission and Distribution of Electricity from a Distance.*

By H. F. Parshall.

In introducing for discussion so broad a subject as the economical distribution and transmission of electricity from a distance, only a very general statement is possible, since local conditions cause widely different conclusions to be arrived at in different cases.

The subject may be subdivided into: (1) Economical generation; (2) Economical transmission; and (3) Economical distribution.

(1) *Economical Generation.*—There is not much to be said on the subject of economical generation, if the electrical conditions alone are considered, since the difference in efficiency, cost and maintenance between types of generators, whether continuous current, alternating or polyphase, is but small.

In dealing with polyphase transmission, there may arise conditions where the use of step-up transformers will be found more satisfactory, commercially, than the use of generators working at very high pressure.

(2) *Economical Transmission.*—In the transmission lines, so far as the cost of conductors is concerned, and the efficiency in transmission up to the commercial limit of cost of generating or transforming apparatus, there is a direct gain in increasing the voltage where overhead lines are permissible. Where underground cables have to be considered, with the present knowledge of cable-making, it may be said that 20,000 volts is the safe limit.

(3) *Economical Distribution.*—This has to be maintained with reference to the conditions to be maintained in the consumer's circuit. These conditions are, as to whether continuous or alternating currents are most adaptable for a particular set of local conditions, or whether the combination of both could be made to meet the widest range, and finally what conditions as to voltage drop have to be maintained. Either for lighting, or in earth returns for electric traction, a very small voltage drop only is permissible.

A number of small electric substations will, from a commercial point of view, be found more economical than would be the case if each were to be a complete generating station. Substation plant can be built free from objectionable vibration or noise, it also occupies exceedingly little space. For these reasons, it can be located in situations which would be impossible if complete generating stations had to be laid down.

Numerous substations involve lower efficiency in transformation, higher first cost of plant, and heavier attendance charges. On the other hand, a saving is effected both in feeders and distributors, and the efficiency of transmission is increased, due to smaller feeder losses. Any general rule as to the most economical number of substations to employ is impossible. For a particular case of fairly uniform distribution over a large area at a rate of 1000-kw or more per square mile, a radius of distribution of half a mile would be warranted from economical considerations.

Smaller supply densities and in general ununiform distribution will increase the economical radius of supply, and diminish the best number of substations.

With short feeders the further advantage is obtained that the feeder drops are smaller, and the consequent variation of voltage at different parts of the system through different feeders loading up irregularly is largely climinated, with consequent simplification in switchboards, better service, and more economical running of the plant.

The arrangement of substations has also to be considered in respect to the nature of the load, so that, in the case of the average load, the losses due to friction and hysteresis will be balanced against the I^2R losses.

In general, it may be said that single-phase transmission has had its day. In any scheme, even though designed primarily with a view to lighting distribution, it becomes necessary to take into account probable demands for power. So far, the single-phase motor has not been a success, and in districts where single-phase plant has been laid down, special arrangements are being generally made for the supply of continuous current for power purposes.

The gradual perfection of the generating apparatus, so that current can be obtained reliably at very high voltage, the high efficiency of the transmitting mains, together with the step-down transformers and rotary converter, and the great flexibility of such system, has led many engineers to believe that polyphase transmission with rotary converters and continuous current distribution will be the ultimate system in dealing with large powers over any extended area. The popular formula among the more progressive engineers is to use polyphase transmission at a periodicity of 25 to 50, at from 5000 to 40,000 volts, according to the distance and conditions of transmission.

There is comparatively little choice between two or three-phase currents. The conditions favoring three-phase transmission are in respect to the small amount of copper required, and greater flexibility in the use of transformers. Thus, without increase in complication, the three-phase system requires but three-quarters of the weight of copper necessary for two-phase currents, and the transformers may be connected for six-phase transformation instead of three-phase in dealing with rotary converters—a condition very favorable to practical working.

The theory of the action of the rotary converter has been definitely laid down, and there is at the present day plenty of experience as to its working in practice. The early difficulties experienced have been largely overcome by more careful design both in the prime mover and in the rotary converter itself. It has been found necessary to give attention to the production of constant angular velocity in the prime mover.

In England, on account of the stringent regulations, in connection with the working of tramways, polyphase currents become economical at less working distance than in most other countries, since the losses due to transformation are compensated for by the advantages gained by centralization. The only two notable polyphase installations in the United Kingdom working are those of Dublin and Middlesborough. There are, however, the greater installations of the Central London Railway, the London United Tramways and the Glasgow and Metropolitan. When these are completed, it can be fairly said that these installations demonstrate the general feeling among engineers, that the polyphase system of generation is the one most likely to give economical results even over comparatively limited areas.

*A paper read June 8 at the Engineering Conference of the English Institution of Civil Engineers.

Welding of Copper.

The following communication was accompanied by two specimens purporting to be copper welded to copper, and copper welded to steel:

"A process has recently been independently perfected by two different inventors in Galesburg, Ill., which seems to be of especial interest to electricians. I refer to the welding of copper. Both inventors are able to weld copper in a forge much as iron is welded, and both succeed also in welding perfectly and apparently with little difficulty, copper to iron or steel. I am satisfied that the points are true welds and are perfect joints mechanically and electrically.

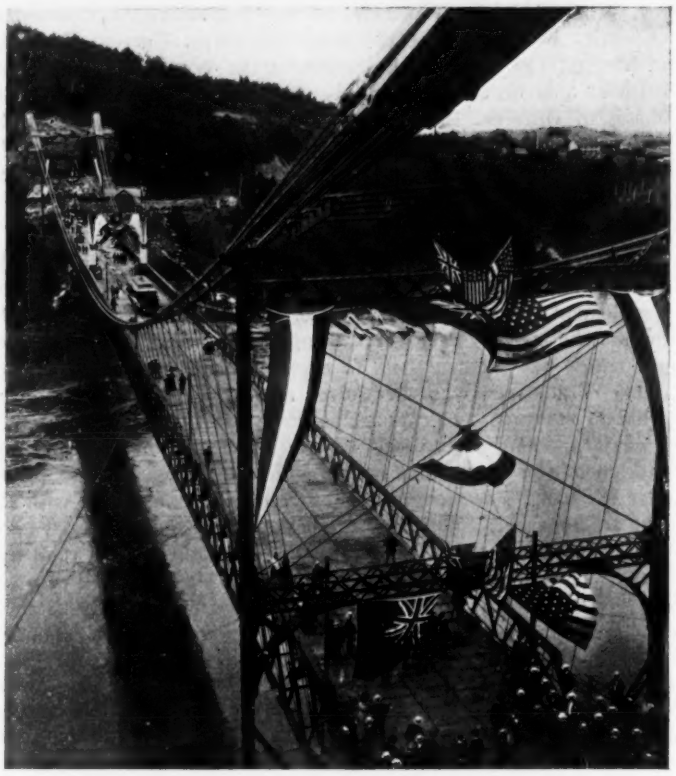
"One of the inventors, August W. Anderson, received a patent on a flux for welding copper dated July 4. Mr. Anderson is a blacksmith who has experimented at welding copper for some time. The other inventor, Mr. Charles G. Wiborg, is a coppersmith, who has been trying for ten years or longer to weld copper. His work is especially remarkable, since he welds the copper without injuring the form of the pieces welded. Two heavy copper bars such as might be used in switchboard construction may be welded without melting off the corners. A copper coin may be welded to a piece of steel without injuring the impression on the coin. The welding of heavy copper wires like trolley wires may be done with a gasoline brazer.

"It might be practicable to bond rails by first welding one or more pieces of copper wire to the rails before they leave the shops, and completing the union by welding the ends of the wires together after the rails are laid. Mr. Wiborg has made a number of joints in my presence with an ease which surprised and pleased me greatly. His process is novel and seems to meet all the requirements of successful use on a commercial scale."

Upon testing the specimens received, that consisting of two pieces of copper came apart at the third blow from a small hammer, and the surfaces exposed showed no indication of a weld. The other piece—steel and copper—was separated at the union by an ordinary jackknife. The specimens appear to have been samples of imperfect brazing or cementing, the joints not being as good as if made with soft solder. By well-known shop processes two pieces of copper, or copper and steel, can be united so that they cannot be separated at the joint.

The New Niagara Bridge.

The International Traction Company formally opened its new suspension bridge across the Niagara River, a short distance above the villages of Lewiston, N. Y., and Queenston, Ont., on Friday, July 21. In opening this great structure to the public the International Traction Company made the event one of international importance. President Ely of the Traction Company had issued handsome invitations bearing the flags of both countries interested, and with the invitation was enclosed a card entitling the holder to free transportation over all the company's lines, 318 miles in all, and over their two great Niagara bridges for two days. The invitations called the guests together at either end of the bridge at 12:30 o'clock, and soon after that hour the New York and Canadian



VIEW OF THE NEW NIAGARA BRIDGE.

guests moved out from their respective ends of the new structure and met in congratulations under an "Annexation Arch" in the centre. There was music, and then the party moved to Queenston Heights, where luncheon was served, and where the speeches of the day were made, President Ely acting as toastmaster.

It was evident from the general good feeling that the International Traction Company will accomplish much in promoting the good friendship between the peoples of the Niagara border. The bridge has been described at length in these columns. It is 1,040 feet long in the cable span, while the suspended truss is 800 feet long. It has a width of 25 feet, and through the centre of the floor there is laid a single track for electric cars. The bridge will be a link in a belt line trolley service about the gorge.

Training School for Signal Corps.

Gen. Greely, of the Signal Corps, will, it is stated, establish a school at Fort Myer for the instruction of men of his command and where experiments with new inventions will be made. The school will be opened about Oct. 1, when three automobiles, which have been contracted for from a Chicago firm, will be delivered. Two of these machines will be used in connection with wireless telegraphy. Each will be equipped with a complete set of instruments, and they will be sent to different parts of the country to conduct experiments under all conditions. The third automobile will be used for general transportation purposes, and the utility of these machines will be given a practical test. There will be accommodations for at least 100 men. They will be put through a course of training in the duties exacted of them, and after a term at this school the members of the Signal Corps will be well equipped for their duties and have a great deal of practical knowledge about electricity and telegraphy.

Electrical Standardization—V.*

REGULATION.

The term regulation should have the same meaning as the term "inherent regulation," at present frequently used.

The regulation of an apparatus intended for the generation of constant potential, constant current, constant speed, etc., is to be measured by the maximum variation of potential, current, speed, etc., occurring within the range from full load to no load, under such constant conditions of operation as give the required full-load values, the condition of full-load being considered in all cases as the normal condition of operation.

The regulation of an apparatus intended for the generation of a potential, current, speed, etc., varying in a definite manner between full-load, and no-load, is to be measured by the maximum variation of potential, current, speed, etc., from the satisfied condition, under such constant conditions of operation as give the required full-load values.

If the manner in which the variation in potential, current, speed, etc., between full-load and no-load is not specified, it should be assumed to be a simple linear relation; i. e. undergoing uniform variation between full load and no load.

The regulation of an apparatus may, therefore, differ according to its qualification for use. Thus the regulation of a compound-wound generator specified as a constant-potential generator will be different from that it possesses when specified as an over-compounded generator.

The regulation is given in percentage of the full-load value of potential, current, speed, etc., and the apparatus should be steadily operated during the test under the same conditions as at full-load.

The regulation of generators is to be determined at constant speed; of alternating apparatus at constant impressed frequency.

The regulation of a generator-unit, consisting of a generator united with a prime mover, should be determined at constant conditions of the prime mover; i. e. constant steam pressure, head, etc. It would include the inherent speed variations of the prime mover. For this reason the regulation of a generator-unit is to be distinguished from the regulation of either the prime mover, or of the generator contained in it, when taken separately.

In apparatus generating, transforming or transmitting alternating currents, regulation should be understood to refer to non-inductive load, that is to a load in which the current is in phase with the e. m. f. at the output side of the apparatus, except where expressly specified otherwise.

In alternating apparatus receiving electric power, regulation should refer to a sine wave of e. m. f., except where expressly specified otherwise.

In commutating machines, rectifying machines and synchronous machines, as direct-current generators and motors, alternating current and polyphase generators, the regulation is to be determined under the following conditions:

a. At constant excitation in separately excited fields.

b. With constant resistance in shunt field circuits and

c. With constant resistance shunting series fields; i. e., the field adjustment should remain constant, and should be so chosen as to give the required full-load voltage at full-load current.

In constant-potential machines, the regulation is the ratio of the maximum difference of terminal voltage from the rated full-load value (occurring within the range from full-load to open circuit) to the full-load terminal voltage.

In constant-current machines, the regulation is the ratio of the maximum difference of current from the rated full-load value (occurring within the range from full load to short circuit), to the full-load current.

In constant-power machines, the regulation is the ratio of maximum difference of power from the rated full-load value (occurring within the range of operation specified) to the rated power.

In over-compounded machines, the regulation is the ratio of the maximum difference in voltage from a straight line connecting the no-load and full-load values of terminal voltage as function of the current, to the full-load terminal voltage.

In constant-speed continuous-current motors, the regulation is the ratio of the maximum variation of speed from its full-load value (occurring within the range from full-load to no-load) to the full-load speed.

*Report of the Institute Committee on Standardization of Generators, Motors and Transformers.

In transformers, the regulation is the ratio of the rise of secondary terminal voltage from full-load to no-load (at constant primary impressed terminal voltage) to the secondary terminal voltage.

In induction motors, the regulation is the ratio of the rise of speed from full-load to no-load (at constant impressed voltage), to the full-load speed.

The regulation of an induction motor is, therefore, not identical with the slip of the motor, which is the ratio of the drop in speed from synchronism, to the synchronous speed.

In converters, dynamotors, motor-generators and frequency changers, the regulation is the ratio of the maximum difference of terminal voltage at the output side from the rated full-load voltage (at constant impressed voltage and at constant frequency), to the full-load voltage on the output side.

In transmission lines, feeders, etc., the regulation is the ratio of maximum voltage difference at the receiving end, between no-load and full non-inductive load, to the full-load voltage at the receiving end, with constant voltage impressed upon the sending end.

In steam engines, the regulation is the ratio of the maximum variation of speed in passing from full-load to no-load (at constant steam pressure at the throttle), to the full-load speed.

In a turbine or other water-motor, the regulation is the ratio of the maximum variation of speed from full-load to no-load (at constant head of water, i. e., at constant difference of level between tail race and head race), to the full-load speed.

VARIATION AND PULSATION.

In prime movers which do not give an absolutely uniform rate of rotation or speed, as in steam engines, the "variation" is the maximum angular displacement in position of the revolving member expresed in degrees, from the position it would occupy with uniform rotation, and with one revolution as 360°; and the pulsation is the ratio of the maximum change of speed in an engine cycle to the average speed.

In alternators or alternating-current circuits in general, the variation is the maximum difference in phase of the generated wave of e. m. f. from a wave of absolutely constant frequency, expressed in degrees, and is due to the variation of the prime mover. The pulsation is the ratio of the maximum change of frequency during an engine cycle to the average frequency.

If n = number of poles, the variation of an alternator is $\frac{n}{2}$ times the variation of its prime mover if direct connected, and $\frac{n}{2}p$ times the variation of the prime mover if rigidly connected thereto in the velocity ratio p.

The pulsation of an alternating-current circuit is the same as the pulsation of the prime mover of its alternator.

CURRENT NEWS AND NOTES.

CABLE OPERATIONS AT MANILA.—A special cable despatch from Manila of July 28 says: There is great interest in the first attempt of a cable boat to follow the movements of the army. The boat left Tambay, near Taguig, at the northern end of Laguna de Bay, this morning, after making connection with the land wire, and successfully laid eighteen miles of cable. It is expected that the boat will reach Calamba to-night. The work was done by Major Maxfield with some of the American cable taken out by the Hooker.

"ROBBING AIR OF ITS ELECTRICITY."—A Pittsburg genius has, according to a local paper, "solved the problem of robbing the air and its moisture of its power and storing it in a battery in the form of electrical energy." Later experimental batteries, says the writer of the article, in referring to the energy of the battery, "have shown 2½ volts to each cell and an amperage much higher than any other storage battery." The inventor states that with the introduction of his new battery in commercial form the use of steam will be abandoned and electric power will be universal.

NEW FORM OF CONDENSER.—A patent was issued July 25 to Peter Cooper Hewitt for a form of condenser which will induce a current in a neighboring closed circuit to light a lamp or attain a similar object requiring a comparatively low e. m. f. and large current. The coatings consist of concentric rings of foil on the dielectric, the rings being so connected as to cause the charging or discharging current to flow in a spiral path. The condenser will thus produce a magnetic field which, acting upon a neighboring closed circuit, will induce in it a current.

ENGINEERING EDUCATION.—The seventh annual meeting of the Society for the Promotion of Engineering Education will be held at Columbus, Ohio, on Aug. 17, 18 and 19. President T. C. Mendenhall will deliver his address at the opening of the business meeting on Aug. 17. Among the papers to be read are the following: "The Essentials of a Technical Education," by Prof. A. L. Rice, of Pratt Institute, Brooklyn; "The Place of Correspondence Schools in Engineering Education," by Prof. Edgar Marburg, of the University of Pennsylvania; "Engineering Education and Expansion," by Prof. W. S. Aldrich, of the University of Illinois; "A Convenient Laboratory Equipment for the Study of Direct Current Dynamos and Motors," by Prof. H. B. Smith, of the Worcester Polytechnic Institute; "A Comparative Study of the Electrical Engineering Courses in Different Institutions," by Prof. F. C. Caldwell, of the Ohio State University, and "The Desirability of Uniformity in the Use of Mathematical Symbols and Terms," by Prof. A. E. Haynes, of the University of Minnesota, besides many others.

THE CLEVELAND STRIKE.—The strike on the "Big Consolidated" railway in Cleveland continues, with no apparent indication of settlement. According to many of the published reports on the situation the strikers have very strong moral support from the citizens, which has enabled them to apply the boycott to a very wide extent. Tradesmen who themselves ride or allow their employees to ride on the company's cars are boycotted, and this modern weapon of warfare seems to be very effectively wielded in this instance. Tradesmen who supply the troops with provisions are also placed under the ban. The riotous demonstrations in connection with the strike are apparently subsiding, although an occasional outburst takes place. It is stated by the officials of the Big Consolidated road that all of its lines are in operation. The strikers state that the cars run empty on account of the boycott. On the evening of July 28 a car was blown up by some explosive placed upon the track. The car was badly damaged, but no one was hurt. Troops and police were at once despatched to the scene, but no clue to the perpetrators of the deed could be found. This incident following a period of quiet for two or three days has renewed the feeling of uneasiness throughout the city. The officials of the Big Consolidated road have offered a reward of $1000 for the arrest and conviction of the persons who placed the dynamite on the tracks a couple of weeks ago, when a car was destroyed. At last accounts the strike is still on.

STRIKES OF MESSENGERS.—During the past fortnight there has been much unrest among telegraph messengers in many of the large cities throughout the country. Strikes have occurred in some places, and in most instances the youngsters, believing that strike, intimidation and lawlessness were synonymous terms, carried on their warfare against the "soulless corporations" in a fashion that was unique. In New York the messengers of the American District Telegraph Company, who deliver Western Union messages, and the Postal boys, struck for free uniforms, a fixed schedule of wages and fewer hours of work. The boys sent out pickets, who waylaid and intimidated those who did not strike and the new boys who took the places of the strikers. After a few days' harmless excitement the boys gave up the fight and applied for reinstatement. The officials of the employing companies think that outside influences led the messengers astray. At Wilkesbarre, Pa., the messengers of both the companies struck on July 24 for an increase of wages. They employed the same tactics to gain their point as were used in New York, and the police were called out to preserve order. The boys were defeated. The strike epidemic caught the messengers in Cincinnati, Pittsburg and Syracuse. In Cincinnati considerable violence occurred. Two boys were stabbed and missles were thrown at the so-called "scabs." It required the services of the police in almost every case to keep the youngsters from going too far in their lawlessness. More or less inconvenience was caused to the public by the strikes. In Boston and other places the messengers were uneasy and threatened to tie up the telegraph service, but the ill-luck that attended the strikes in other cities had a disheartening effect upon them, and they did not carry their threats into execution.

A YEAR'S FIRE LOSSES.—The review of the fire waste in the United States during 1898, as shown by the *Chronicle* fire tables, has just been issued. The editor says: "The fire waste in 1898, which was $130,593,905, brings the record of the fire loss in this country during twenty-four years up to the enormous total of $2,585,186,186. The sum distributed by the insurance companies last year was $73,790,080, and the total sum distributed by the insurance companies during twenty-four years amounts to $1,512,698,528." The average property loss per fire during 1898 was $1868, and the average insurance loss was $1056. Of the kinds of property burned, 44.75 per cent. consisted of dwellings and boarding houses, 6.29 per cent. hotels, clubs and restaurants; 81 per cent. theatres, public and private halls; 18.02 per cent. livery stables, barns, tobacco barns, etc.; 19.77 per cent. stores, offices, etc., and miscellaneous 4.28 per cent.

TELEPHONE RELAYS.—In a communication received from Mr. A. R. Bennett in response to an inquiry concerning his work on telephone relaying, he says that his last attempts were in 1887 or 1888, when he drove an Edison chalk-cylinder receiver by clockwork and caused the diaphragm to operate a new transmitter. Some urgent business requiring his notice just then, he relinquished the experiments and never renewed them. It is added that distances being so much shorter in Great Britain than in the United States, the want of a relay has not, so far, been felt in the former country, but possibly the contemplated telephonic connections between chief British and continental centres may revive interest in the subject.

SUNDAY STREET CARS IN OTTAWA.—The Ottawa, Ont., city council last week passed a by-law authorizing the running of street cars on Sunday, which was carried by only one vote. One of the opposing aldermen then gave notice of motion to reconsider, but the mayor declined to receive it, announcing the council adjourned. The city solicitor subsequently declared that the notice to reconsider was properly made and refused to draw up the Sunday car by-law. The mayor thereupon quietly took it to another city lawyer and had it legally drawn up and then it was signed and sealed by the mayor and street railway company, and is irrevocable. The franchise grants the right to operate the cars on Sunday for twenty-four years.

ELECTRICITY IN ECUADOR.—In a recent letter from Consul-General De Leon, at Guayaquil, Ecuador, that official calls attention to the absence of electrical enterprise in that city. He states that no electric power is used there, neither is there any demand for electrical supplies. He believes, however, that there is an excellent opening for an electric light and street railway service. Guayaquil. is a prosperous city of about 50,000 inhabitants, and with the construction of the proposed railway to Quito is bound to increase in population and wealth. It is at present lighted by gas of poor quality, which costs the municipality a considerable sum annually. A street car system traverses almost every street; but mules, the motive power, are costly. Fuel is scarce and expensive, but superb water power is available at some distance from the city. In 1896, the installation of an electric light service was in progress; but the great fire destroyed the work and caused the enterprise to be abandoned. The time seems ripe, Mr. De Leon says, for a system combining transportation and illumination.

THE TEXAS ANTI-TRUST LAW AND TELEPHONE COMPANIES.—Attorney General T. S. Smith, of Texas, has been requested to render an opinion on an interesting question relating to the interchange of business between rival telephone companies in that state. The Southwestern Telephone Company has almost a monopoly of the telephone business in Texas, but there are a few towns in which rival telephone exchanges are maintained. It is alleged that the Southwestern Company refuses to allow connections to be made by these rival companies with its long-distance telephone circuits, and the question propounded to the Attorney General is whether or not this action on the part of the Southwestern Telephone Company is in restraint of trade and in violation of the anti-trust law of the state. An opinion on the subject will probably be rendered in a few days. If it is held that the Southwestern Telephone Company cannot deny the right of rival companies to make such connections, it is probable the matter will be carried into the courts and a test case made on this important point. A final decision of this character would lead to the establishment of rival telephone exchanges in many of the cities and towns of the state.

MERSHON POTENTIAL INDICATOR.—A patent was issued July 25 to Ralph D. Mershon for a method of indicating at an alternating current generator station or any desired point the potential at any given point of the line without running out pressure wires, whatever may be the ohmic or induction drop in the line or other disturbing effect tending to vary the potential at the load from that at the generator end of the line. The present patent relates to the case of long transmission lines where there is more or less current due to capacity effects, loss between wires through the air and over insulators, and where power is delivered at various points along the line subject to the condition that where a load is located at two or more points in the line, the power taken at each point is constant. The system consists, broadly, in reproducing in miniature at the generating or other desired point the conditions of the line with respect to distributed leakage, inductance and capacity, and also line resistance and distributed load. The local indicating circuit comprises an arrangement of resistances, inductances and condensers so connected and proportioned as to be a miniature representation of the line and its load; consequently, when subjected to an e. m. f. proportional to that of the line, instruments located on the miniature circuit will indicate as if they were on corresponding points of the main line.

INTERNATIONAL CONGRESS OF PHYSICS.—The Société Francaise de Physique has taken the initiative with respect to an International Congress of Physics, to be held at Paris during the week commencing Monday, Aug. 6, 1900. A definite programme has not been decided upon, but it will comprise reports and discussions on a limited number of subjects decided upon in advance, such as definitions and determinations of certain units, photometric units, spectral scale, electrical units not yet defined, etc., bibliography of physics, national laboratories. 2d. Visits to the Exposition, laboratories and works. 3d. Lectures on several new subjects. The price of a card for the congress is 20 francs, which gives a right to participation in the entire programme and to the published proceedings of the congress. The Committee of Organization consists of M. Cornu, membre de l'Institut and professeur à l'Ecole Polytechnique, president; M. Cailletet, membre de l'Institut, vice-president; M. Guillaume, International Bureau of Weights and Measures, and M. Poincaré, professor at the Surbonne, secretaries; Members, MM. D'Arsonval, Bassot, Becquerel, Benoit, Bichat, Blondlot, Crova, Joubert, Lippmann, Lepinay, Mascart, Mathias, Pellat, Potier and Violle. The committee will receive with pleasure suggestions relative to the programme. In order that the committee in charge shall know the probable number of members of the congress, all of those interested who desire to be enrolled are requested to forward their names to Ch. Ed. Guillaume, secretary, Pavillon de Breteuil, Sevres, France.

COPPER FOR VARIOUS TRANSMISSION SYSTEMS.—Swinburne gives the following comparison as to amount of energy with the same loss that will be transmitted at 10,000 volts by 2 cm² of copper at a density of 200 amperes per square centimetre, the voltage being the maximum to which the insulation will be subjected. In Case 1 the system is earthed at a middle point, no wire to be more than 10,000 volts from earth. The direct current is then 20,000 volts and 200 amperes. The single-phase has 7100 each side, the two-phase the same, but has its thick wire grounded, and has smaller currents. The three-phase has a middle point earthed, and though its wires never go over 10,000 volts above earth, they go more from each other. In Case 2, one conductor is earthed. This is a condition that may be compulsorily enforced, and practically means concentric mains with little insulation on the outside conductor. In this case the direct current has 10,000 volts and 200 amperes, the single-phase 7100 and 200, the two-phase is as before, but the three-phase current comes down considerably. Case 3 is where the difference between no two conductors exceeds 10,000 volts. In each case the leads have

Case.	System.	Output in Kilowatts.	Case.	System.	Output in Kilowatts
1	Direct.....	4,000	2	Two phase.....	1,650
1	Single phase.....	2,824	2	Three phase.....	2,824
1	Two phase.....	1,650	3	Direct.....	2,000
1	Three phase.....	5,000	3	Single phase.....	1,412
2	Direct	2,000	3	Two phase.....	1,170
2	Single phase.....	1,412	3	Three phase.....	2,824

a total area of 2 sq.-cm., and a density of 200 amperes per sq.-cm. In all these cases the three-phase is best and the direct second.

FRANCHISES IN PUERTO RICO.—The U. S. Attorney General has rendered opinions in cases involving questions of franchises and concessions in Puerto Rico. In the cases of Vincent and José Usera, he holds that they do not hold a complete and lawful concession to build a tramway from Ponce to Port Ponce, and that the Secretary of War has not right to confirm such concession.

THEORY OF THE COHERER.—In the current number of the *Revue Generale des Sciences,* M. Broca reviews the several explanations of the action of the coherer, and adopts that of Lodge. This theory, as stated by M. Broca, is that the filings, rendered normally non-conducting by a coating of oxide, become conductive upon the passage of sparks set up by Hertzian waves between the particles, through the sharp projections becoming soldered together, or at least coming into intimate contact at the points rendered bare and melted by the action of the sparks.

EXPLODING POWDER BY ELECTRIC WAVES.—According to a London despatch, dated July 26, experiments were conducted at Newbury to determine the possibility of exploding powder at a distance by means of electric waves. A small powder magazine located 400 yards from the point of origin of the waves was successfully exploded. This test is regarded by the source of our information as demonstrating the feasibility of using the system for the destruction of mines, etc., during war. Absence of details does not permit the truth of this conclusion to be judged. It will be remembered that one of the features of the 1898 New York Electrical Exposition consisted in the explosion of mines under a model torpedo boat—with a coherer introduced into the exploding circuit.

KELVIN'S DISCOVERY.—Apropos of Lord Kelvin's recent investigation of the force exerted on an electric charge by a varying magnetic field, the London *Electrician* directs attention to an article by M. Blondlot, "Sur une loi élémentaire de l'induction électromagnétique," which appeared, in 1890, in the *Journal de Physique,* p. 177. The article presents no direct experimental evidence, but, following the lines of Hertz, Heaviside and other theorists, our contemporary states, it gives a strikingly elegant and neat account of the deductions by which the same conclusion as that reached by Lord Kelvin might be arrived at. M. Blondlot concludes his article with a summary, of which the following is a translation: "The same displacement given to an electric charge and to a magnetic pole, having equal numerical values, produces in each point in space correspondingly equal magnetic and electric forces."

OPERATIVE COSTS OF DIFFERENT TRACTION SYSTEMS.—In a paper read at the recent English Engineering Conference by Thomas Parker, M. I. C. E., data from practical working is given as to the cost of operation of horse, electric and cable railways, and light steam railways, as follows, per car mile: Horse, 26-ton cars (loaded), 15.56 cents; steam, 54-ton cars, 18 cents; cable, 54-ton cars, 8.8 cents; overhead trolley, 30-ton cars, 6.3 cents; electric elevated, 140-ton cars, 8.6 cents. In a paper read at the same meeting by Granville C. Cunningham, M. I. C. E., the operative cost of horse traction, exclusive of drivers' wages, is given as varying from 7 cents per car mile in an easily worked city such as Glasgow, to 10 cents per car mile in a hilly city, such as Liverpool. The cost of electric power—comparative with the above cost of horse traction—should be less than one cent per car mile in the first case, and slightly over one cent for the second. It was stated that in Montreal current for electric traction was produced for a little over a half-cent per kw-hour, and that the cost of electric traction with coal at $2.25 per ton was less than a cent per car-mile. The average consumption of coal was 2.75 lbs. per electric horse-power.

STEAM VS. ELECTRICITY IN MINING.—In a paper read by Henry Slade Childe, M. I. C. E., before the recent Engineering Conference of the English Institution of Civil Engineers, the comparative advantages of electricity, steam and compressed air for mining purposes are examined, and the conclusion arrived at that for general surface purposes steam is undoubtedly first, while for working in shafts and for all underground work electricity has the advantage over compressed air except on the one ground of safety. As to this exception, the author admits that no explosions have been traced to electricity, but considers that "it stands to reason that if an explosive admixture comes in contact with an electric spark an explosion must result; it cannot, therefore, be used with complete safety, although with polyphase currents no sparking will occur as there are no rubbing contacts; but even this is not quite satisfactory." In another paper read at the same meeting by William Edward Garforth, M. I. C. E., a similar comparison is made and the conclusions drawn that high pressure dry steam is the most economical source of power for use on the surface; that electricity is the most economical and convenient for transmission of power; that compressed air is the safest underground, and that a combination of the three will probably give the best results. The papers were interesting to engineers.

A NEW RESISTANCE MATERIAL.—The London *Electrician* states that an English company with a large capitalization has been formed to exploit an invention which has been in use for some time in Austria and Germany, viz., a resistance material which obviates the necessity to break contact in changing the resistance in circuit. The resistance is practically a mixture of finely powdered carbon and kaolin moulded into any required shape. Thus for an ordinary rheostat controller it is moulded into a stout ring of rectangular section. A sliding contact carried at the end of a revolving lever, and pivoted at the centre of the circle, allows of the current being taken off at any point on the surface of the ring, current being led into the ring by means of a copper plate embedded in it and made flush with the upper surface. The specific resistance of this combination of carbon and kaolin can be made sufficiently high to allow of very high resistances being introduced into the circuit by means of rings of only moderate dimensions, while at the same time sufficient radiating surface is exposed to allow of the energy being dissipated without excessive heating. Our contemporary states that the advantage of this method of construction for large power rheostats will be evident to all who have had to do with the regulation and breaking of heavy currents, and adds that it nas had an opportunity of observing its utility for ordinary electric heating and warming purposes. Thus a small glass pot of the material, when filled with cold water and plugged on to a 100-volt circuit, raised the water to boiling point in less than a minute.

STORAGE BATTERY PATENTS.—Among the patents issued July 25 are four on forms of storage battery plates. Two of these were issued to Charles W. Kennedy, and describe plates each consisting of a number of arms or fingers transversely secured like the tines of a fork to a conducting bar; each cell consists of two of these relatively shallow constructions interleaved, and placed in a shallow rubber tray, the trays being superposed with the bottoms resting on the tops of the elements of the cells underneath. One patent describes an element having six transverse arms or tines, each in the form of a long closed receptacle of comparatively small cross-section, made of sheet lead and pierced with numerous small holes. The receptacle is filled with active material, and an element consists of a number of these secured transversely to a conducting bar. The second patent describes a similar construction, but with tines consisting of coils of narrow corrugated lead tape secured in holes made in carrying arms or plate strips. As illustrated, there are eight pellets to the carrying arm, six arms or more being secured to a transverse bar to form an element. An interleaved positive and negative in a shallow rubber tray forms a cell, as in the first case. In a patent issued to H. F. Vogel, of Berlin, Germany, a plate is described, having a peculiar form of grid bar. The plate consists of the usual rectangular frame, but with horizontal bars made up of numerous triangular shapes, the apex of one triangle being at the middle of the base of the two adjacent ones—the frame and bars being cast together. As will be seen, this gives a lozenge shape to the continuous portion of the horizontal bar, upon which its mechanical strength depends, and multiplies the surface subject to useful action. A patent issued to R. Ashley describes a plate consisting of a number of relative shallow transverse frames or grids cast to a conducting bar, this arrangement being thus somewhat similar to that described in the Kennedy patent. Indented or roughened lead tape strips are secured vertically into grooves in the upper and lower bars of the transverse grids or holders, which bars being strengthened by vertical cross bars at intervals. A cell consists of two of these constructions interleaved in a shallow rubber case; a number of cells are stacked together or superimposed, and the positives and negatives respectively connected in parallel.

MINE HAULAGE PRACTICE.—In a paper by Harry K. Myers in the July number of the *Proceedings* of the Engineers' Club of Philadelphia, on "Modern Mine Haulage Practice," it is stated that at the present time there are fully 400,000,000 tons of different minerals hauled annually over 50,000 miles of track, with an average haul of one mile per ton at a cost of fifteen cents. In the transportation of this material 100,000 mules are required, whose average life is four years each, to drive and maintain which costs $60,000,000 per annum. It is added that with such an amount involved it would appear to be a matter of a short time when animal power would be a thing of the past, and power haulage universally adopted. The author states that in general it costs from 6 to 10 cents per ton to deliver coal from the face of working to the shaft, slope of tipple, where the haul is one mile and the shaft approximately level; yet he knows of three mines using electric haulage, where a round trip of 9000 feet is made at the cost of one cent per ton.

CHAUDIERE FALLS POWER SCHEME.—A scheme for the harnessing of the entire water power of the Chaudiere Falls of the Ottawa River is projected. A prominent electrical and hydraulic engineer of Ottawa has for some time been at work devising a means to avoid the immense waste of water, consequently of power, and has arrived at the conclusion that a canal would be the most effective and feasible means to prevent it. Instead of having, as at present, seven or more power houses, operated by as many concerns at the falls, one large establishment would serve for all. Not only does a large amount of water escape without being utilized, but the distribution of the water that is harnessed is very wasteful both in head and tail races. It has been calculated that the falls can yield 160,000 horse-power. All this can be made use of. A new dam would have to be built above the falls, and this done, practically no water need go down over the drop.

A NEW POWER DEVELOPMENT.—It is reported from North Tonawanda, N. Y., that a company has been incorporated to establish an electric water power plant on the banks of Eighteen-Mile Creek, near Newfane Station, Niagara County, N. Y., within the next few years. The company is composed of Lockport and New York capitalists, and, it is stated, has several hundred acres of land in the vicinity of Newfane. It is expected that a new city will grow up with the development of the power plant. A large dam will be constructed, 50 feet high, with a concrete foundation, while the superstructure will be built of steel. General Manager Ransom, of the Lockport Linen Mills, is one of the principal backers of the scheme, and one of the first big manufacturers to locate on the banks of the creek at Newfane will be a large linen mill. The promoters predict that manufacturing concerns will line both sides of the creek from the dam to Lake Ontario. Cotton, woolen and linen mills will be the principal industries.

LETTERS TO THE EDITORS.

Prevention of Sparking on Breaking Circuit.

To the Editors of Electrical World and Engineer:

Sirs:—Among the "Current News and Notes" in your issue of July 29 is a descriptive reference to a patent recently granted to Adolph Muller, of Hagen, Germany, on the prevention of sparking upon breaking circuit.

After more than three years' experimental use of an identical arrangement, I can vouch for its efficacy, at least so far as being a preventive of sparking at contact points on the breaking of a circuit.

In 1893, while endeavoring to find some more positive means than was then employed or known for preventing sparking at the local contact points of relays, I discovered that two pieces of copper of suitable dimensions placed at a proper distance apart, immersed in acidulated water and so connected up as to form a shunt around the relay and sounder, entirely eliminated the spark from the local contacts of the relay on the break of the circuit.

A device of this kind was thoroughly tested during the years 1894 and 1895 on the cables of the Central & South American Telegraph Company at their stations in Galveston and Vera Cruz, and with entire success so far as preventing sparking in the local contacts of cable relay for Morse work, then being operated there. In view of these dates and facts the novelty of the Muller invention seems questionable.

CHARLES G. BURKE.

NEW YORK.

Electrical Energy from Carbon.

To the Editors of Electrical World and Engineer:

Sirs:—In reply to the criticism of my paper made by Mr. Charles J. Reed, in your issue of July 29, to avoid error, I would call attention to the fact that he has misunderstood me. The electromotive forces of .25-volt and higher, were obtained only when ferrous chloride was present in the carbon electrode and in the two-fluid cell of ferric and ferrous chloride, as shown in the paper; the latter cell giving an electromotive force, as stated, of .44-volt, which Mr. Reed refers to as the "carbon cell without carbon, giving a better result."

Now for the important part of the matter. Mr. Reed questions whether or no ferric chloride can be reduced to ferrous by carbon. I used the purest carbon that I could obtain, as reference to my paper will show. Now, assuming that the carbon was pure, the following method was used, which is the further data that Mr. Reed calls for in proof of the fact that carbon is oxidized to CO_2 by ferric chloride. The matter will be explained by referring to the paper for accuracy, and inserting after the words:

"To determine the CO_2 formed in the second flask which was run in parallel, the ordinary method of determination was used," the following, namely: "The flask was introduced into a chain, consisting of K O H tube, flask, condenser, concentrated H_2SO_4, pumice stone, saturated with anhydrous Cu SO_4, Ca cl_2 tube, K O H bulb and Ca cl_2 bulb to aspirator. The K O H bulb and Ca cl_2 tube were weighed and a blank was run to see if the apparatus was in working order. The weight was found to be constant; the flask containing the Fe cl_2 and CO_2 was then introduced into the chain and the determination was made by boiling the solution for ten minutes and drawing air free from CO_2 through for twenty minutes more."

What I assert is that carbon reduces ferric chloride to ferrous, with the production of electrical energy; that air will oxidize the reduced ferrous to ferric chloride; and so we have electrical energy from carbon and air at normal temperature in the manner set forth in my paper.

WILLARD E. CASE.

ENSEMORE, N. Y.

Automatic Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—The article in your issue of July 15, on the "Pollak-Virag Machine Telegraph System," is very interesting, but it looks to the writer like a step backward.

In November, 1880, a patent was granted to Messrs. Taylor and Smith, of New York, covering an automatic system of telegraphy, which seems to embrace all the desirable features of the Pollak-Virag system, while being much more simple. The perforated tape

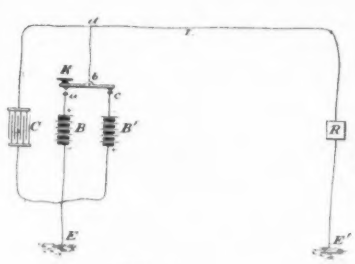


FIG. 1.

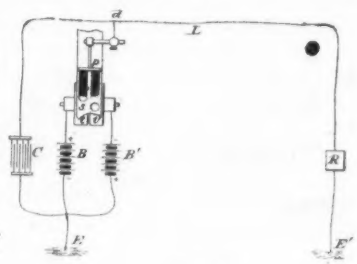


FIG. 2.

was first prepared by means of a keyboard perforator. The sample of perforation herewith shows the words "on for a." The patent specifications show how the tape stencil was run through the transmitter, the signals being transmitted alternately. The receiver consisted of a platinum wheel rotated by hand, and over which passed a roll of chemically dampened tape. Two fine steel points rested on the tape, one point being connected to the line and the other to the

earth. A chemical decomposition was set up between the tape and the steel point which at the instant represented the positive pole. The sample shown shows the words "strike quick."

This system was in use between Boston and New York over the lines of the American Rapid Telegraph Company during the years 1881-83. A transmitting speed of 1500 words a minute—90,000 words an hour—was easily secured, and the system given a most thorough commercial trial. It was afterwards abandoned, however, for straight Morse.

J. Scribner.

Chicago, Ill.

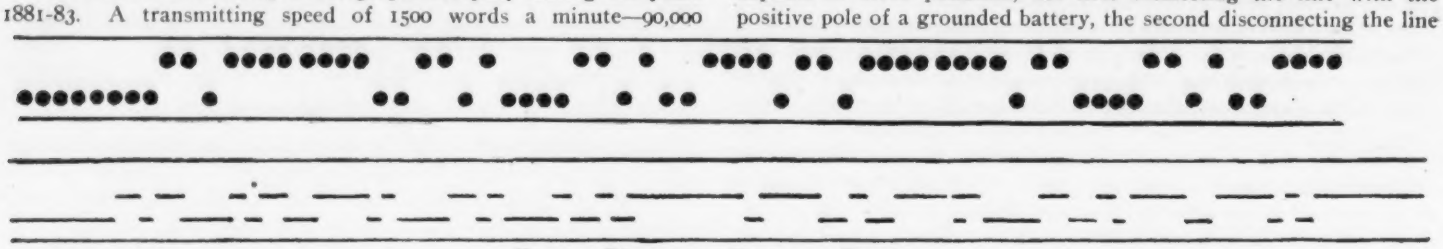


Fig. 3.—Perforated Tape and Record.

[The patent referred to (No. 234,347, dated Nov. 9, 1889) claims a method of transmitting alternate pulsations of positive and negative electricity through a telegraphic circuit, consisting in accumulating a charge of electricity in a static condition at the sending station of the same polarity as the outgoing current, and then discharging the same into the line, so as to prolong the duration of the current; also "the combination of a telegraph line, a key or transmitter capable of three positions, the first connecting the line with the positive pole of a grounded battery, the second disconnecting the line from the earth, and the third connecting the line with the negative pole of a grounded battery, and a condenser having one of its terminals connected to the earth and the other to a point between the key and line." The use of a perforated tape is referred to in the specification, but not claimed as part of the invention. The method of receiving the signal is not mentioned. The two drawings accompanying the specification are reproduced on page 205.—Eds.]

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

Dynamos, Motors and Transformers.

Single-phase Induction Motors.—Eichberg.—A short communication claiming that a certain statement in Steinmetz's recent article (Digest, July 29) is incorrect, namely, that the starting torque of a single-phase induction motor is always positive, whatever the armature resistance is. He says that a certain 8-hp single-phase motor gave a small negative starting torque, if he added proper resistance in the armature circuit.—*Elek. Zeit.*, July 13.

REFERENCES.

Composite Brushes.—An illustrated description of a brush, part of which is copper and part carbon, the latter forming that part which last leaves the commutator bars. These brushes are claimed to increase the range of the sparkless position.—*Elek. Anz.*, July 9.

Carbon Brush Holders.—Three illustrated communications on the question of what is the best form of carbon brush gear for motors.—Lond. *Elec. Eng.*, July 14.

Lights and Lighting.

Nitrate Incandescent Lamp.—A description of a new electric incandescent lamp, taken apparently from patent specifications; nothing appears to be said about its efficiency or practical application. The principle of it is to convert more of the heat into light, by surrounding a white hot metallic filament by a solid electrolyte, which when heated converts more of the heat into light (as in the Nernst lamp). For this material he uses the nitrates of the rare earths (materials similar to those used in incandescent gas lights); a skeleton network of this material, like the hoods of Welsbach lights, surrounds the hot wire.—*Elek. Neuigkeits. Anz.*, July 1.

Power.

Kootenay-Rossland Transmission Plant.—Low.—The conclusion of the illustrated description (Digest, July 15). The principal interest centres in the application of electric power for mining and milling purposes. About 1700-hp are consumed in the operation of hoists, compressors, crushers, conveyors, ventilating blowers and in electrolytic work, the bulk of this power being delivered by induction motors, synchronous motors being used only for the driving of compressors. The method of controlling the speed of the induction motors is fully described; secondary control is used exclusively, that is, the secondary current, induced in the motor circuit, is varied by the introduction of external resistance. One hoist is so controlled that the speed of the motor may be varied from 40 revolutions or less per minute, to its full speed of 300 revolutions. The operation of the controller resembles that in street railway practice. This installation has shown that the operation of synchronous and induction motors in large units for the driving of hoists and compressors, will not necessarily create serious disturbance in the voltage of the distribution circuits, provided high voltage, ample fly-wheel effect and capacity prevails. During daylight the power and lighting circuits are in parallel, but at night they are separated.—*Jour. of El'ty*, June.

Power Transmission by Direct and Alternating Currents.—An editorial article calculating analytically the comparative figures in the different methods of transmitting power. To compare the rival systems on a fair basis, it is claimed to be essential that the efficiency should be the same in each case; this was not done by Swinburne in his recent paper (see Digest, July 8), who arbitrarily fixed a certain current density. The three cases considered by that writer are now worked out analytically on the following bases: weight of copper, efficiency of line and stress of insulating material, to be constant in each case. The conclusions are given in convenient form in tables, giving the power transmitted by the different systems with various power factors for the alternating currents, as compared with the direct currents, showing the superiority of the latter. Two other tables are for finding the size of mains required in transmitting a given power.—Lond. *Elec. Rev.*, July 7.

Electric Power in Brazil.—E. and H. K. Scott.—A short article on the large water powers which are to be found in the neighborhood of all larger cities. These water powers will be utilized in the near future for the production of electric power, as all fuel must now be imported at great cost. Some notes are given as to the American and German electric companies which have been founded for this purpose.—Lond. *Elec. Rev.*, July 14.

REFERENCES.

Electrically Operated Basin for Ship Models.—An illustrated description of the large basin recently completed in the Washington Navy Yard for experimenting with ship models, other references to which have already been given in the Digest.—*Sc. Am.*, July 8; reprinted in part in the *West. Elec.*, July 22.

Traction.

Electric Locomotives.—Elsden-Dew.—A communication referring to a statement in McMahon's paper (see Digest, June 3), in regard to train resistance caused by curves, and the tendency of the wheels to press against the inner or outer rails, while drawing a load or running light. He states that on a line in the Transvaal having a 30-inch gauge, and curves from 50 feet radius upwards, worked by electric locomotives, it was found that the load on the locomotive when hauling the train of trucks, was larger than that when pushing the train; the difference in the time between a pushed and a hauled

train being as much as 5 to 10 per cent. The cause is that in drawing a train around a curve, the rear wheels of the locomotive are drawn against the inner rail and the leading wheels are forced against the outer rails, and there is great friction, while in a pushed train neither wheels are forced against either rail, but seem to oscillate between them. There were only centre buffers; he does not believe the same result would be noticed on any line, as it all depends on the position and distance of the buffers from the wheels.—Lond. *Elec. Rev.*, July 14.

Insulating Material for Trolley Wire Fixtures.—BENZ.—A long, well illustrated description of the numerous different forms of fixtures requiring insulators, as used by the General Electric Co., of Berlin, for overhead wires of electric tramways. As insulating material, a material called "Stabilite" is used, which is claimed to combine the advantages of vulcanized fibre and hard rubber without their disadvantages; its insulating resistance is as good, and it can stand higher temperatures than hard rubber; there is no formation of sulphur, as in hard rubber; it is less hygroscopic and is stronger than vulcanized fibre and is specially adapted for the use on electric tramways, as it can be worked easily and shows no trace of decomposition even in moist air. After having been in moist air for four weeks it had a specific resistance of 8.5 megohm per cm. It is not stated what the ingredients of this material are, nor how it is made. —*Elek. Zeit.*, July 13.

Generation of Power for Electric Traction.—SCOTT.—The continuation of his illustrated article (Digest, July 15). In two diagrams he gives two lighting and tramway load curves in Bradford, the first representing the typical output on a Saturday in summer, the second is plotted from the weekly returns for some nine months, which include the winter season. In each case the tramway load is very regular as compared with the lighting load. He also gives an illustrated description of the traction switchboard of the station in Bradford.—Lond. *Elec. Rev.*, July 14.

Austria.—Brief statistics of the electric tramways in Austria at the end of 1897. The number of lines increased in 1897 from 9 to 14; all are overhead trolley lines. In 6 cases the power stations also furnished power for lighting.—*Elek. Zeit.*, July 13.

Mountain Railway in India.—The Kashmir Railway, to be constructed over 180 miles in the most northerly and most mountainous part of India, will be operated by electricity, water power being used. The use of electricity allows a much lighter engine to be used for drawing the same load and permits of grades which a steam engine could not climb, except with the assistance of a rack and pinion.—From a report of the *Phila. Museum*, reprinted in the *St. R'y Rev.*, July 15.

Automobile.—A note on one made by Siemens & Halske which is provided with guiding wheels enabling it to run on the rails of electric railroads, and when so running it takes current from the trolley wire both for running and charging the batteries; it can also run with its own power when not running on rails. It is specially adapted for connecting street railways through parts of a city where it may not be possible or practicable to lay rails.—*Elek. Anz.*, June 29.

Track Bonding.—APPERSON.—A paper read before a street railway association of Virginia, pointing out the faults of the various bonds and urging the use of a proper method of bonding. Among other things he states that solid copper bonds have practically gone out of use, having been replaced by those of flexible wires. Welded joints have not been a success, as the process decarbonizes the rail ends, softening them at either side of the joint. The cast-welded joint has proved to be fairly good mechanically, but its electrical resistance is high and grows higher in time, which has been proved by thousands of measurements. He recommends the plastic bond, which can stand any amount of hammering and moving, without breaking, as the conducting material is a metallic putty; moreover water cannot penetrate to corrode the contacts.—*St. R'y Rev.*, July.

Electrolysis of Water Mains.—A short note on a possible aid in the solution of the problem of electrolysis produced by return currents. It is proposed to use wooden pipe joints in place of lead. In 1851 the city of St. John, N. B., laid a 12-in., and in 1857 a 24-in. water supply main, some miles in length; instead of running the joints with lead and calking them, pine plugs were employed. Within the past two years this practice has been repeated on another 24-in. supply main, and on some smaller branches. The whole objects seems to have been the saving of expense.—*Eng. News*, July 20.

REFERENCES.

Motive Power for Tramways.—PARKER.—An abstract of a short paper read before the English Institution of Civil Engineers, comparing the relative advantages of horse, steam, compressed air, endless cable, gas and electric traction.—*St. R'y Rev.*, July.

Electric Traction.—GREATOREX.—The beginning of a reprint of an illustrated paper on the different systems of electric traction. The present portion seems to contain nothing new.—Lond. *Elec. Eng.*, July 14.

Egypt.—A short, illustrated description of the electric railroad from Cairo to the Pyramids. The motors and brake controllers for the cars were supplied by the Westinghouse Co.—*St. R'y Rev.*, July.

Louisville.—An illustrated description of the power station and the shops.—*St. R'y Rev.*, July.

Pittsburg.—An illustrated description of the shops of the Consolidated Traction Co.—*St. R'y Rev.*, July.

Decision in the Detroit Case.—A full reprint of the long decision of the supreme court of Michigan holding the law providing for municipal ownership of Detroit street railways to be unconstitutional.—*St. R'y Rev.*, July.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Central Station Statistics for Germany.—Very complete annual statistics, covering 14 pages; they give the data up to March 1 of this year and include only the public stations and those which are not chiefly for tramway purposes. A summary, including tables, is given in an editorial. During the previous year 114 new installations were started, making the total 489 as against 375 during the previous year; 123 are in course of construction. The oldest station in the German Empire is one of those in Berlin which was opened in August, 1885. A brief comparison is made with gas plants and from the growths, it is estimated that in about four years the number of central electric stations will exceed the gas plants. Continuous current is used in 80.6 per cent. of all the stations; the power of the continuous current stations is about 62.3 per cent. of the total of all the stations. During the preceding year some large three-phase plants were started; 91.6 per cent. of the number of continuous current installations are provided with accumulators, the total capacity of which is 37 per cent. of that of the machinery, or 27 per cent. of the total capacity of these stations. The number of (ordinary) alternating current stations has increased but slightly, the outputs of three-phase stations, however, have more than doubled. There are 33 stations using only single or two-phase currents, and the total output is 17,826-kw; the number of three-phase stations increased from 23 to 33, and their capacity to nearly 30,000-kw, which is more than double that in the previous year; besides this there are 22 combined three-phase and continuous current stations with a total output of about 26,000-kw. The increase in output in continuous current stations as compared with the previous year is 32.4 per cent., the total being 92,656-kw; in alternating current stations 21.4 per cent., the total being 17,826-kw; in three-phase stations 113 per cent., total 30,243-kw; in combined three-phase and continuous current 125 per cent., total 25,970; in combined alternating and continuous current the decrease was 10.9 per cent., total 1011-kw. Steam is used exclusively in 59.4 per cent. of stations, or for 76.5 per cent. of the total power; water power is used exclusively in 11 per cent. of the number of stations, or for 10 per cent. of the total power; excluding the large Rhinefeld station, the amount of water power has been greatly reduced, showing that steam and gas has replaced considerable of the water power. The number of stations operated exclusively by gas increased from 14 to 21 and their total power from 1032 to 1610-kw. About 60 per cent. of all the stations have less than 100-kw total capacity; 13 have a capacity between 2000 and 5000 and 4 from 5000 to 12,000-kw; the largest one is the station at Rhinefeld, namely, 12,000-kw, about half of which is used for electrolytic purposes; the second largest is about 7000-kw, in Hamburg, after which comes the largest one in Berlin with 6700. The increase in the number of incandescent lamps is about 36 per cent., arc lamps 26 per cent., and in horsepower of motors 91.3 per cent. Counting 10 incandescent lamps at 50 watts for one arc and 18 for one horse-power of motors, the total connections to the stations amounts to 3,587,000 lamps as compared with 2,400,000 in the previous year and corresponding to 179,362-kw, of which 168,320 is continuous current; the power used for motors is 34.4 per cent. of the total connected power. All the cities in the German Empire having a population of over 100,000 have a central station; 73 per cent. of those between that and 50,000 have such stations. More recently, successful installations have been erected for supplying large districts, including many small towns, from a single

station, and in this direction progress may be looked for.—*Elek. Zeit.*, July 6.

Ashton Combined Plant.—A long illustrated description of this municipal plant and of the Oldham, Ashton & Hyde Electric Tramway. The plant is a combined lighting, traction and destructor station and is claimed to be up-to-date in every respect. The water for condensing is cooled by means of a cooling tower, all the pumps are electrically driven. The dynamos give 550-amp. at 550 volts for traction and 680-amp. at 440 volts for lighting. The switchboard is described in detail. Private lighting is carried out on the three-wire system, with 400 volts between the outers. The public lighting is done with 72 twelve-ampere double carbon arc lamps, arranged four in series between the 200-volt mains. Each circuit is controlled by a two-way switch; by this means the arcs are put out at midnight and replaced by two 16-cp incandescent lamps on each lamp post.—Lond. *Elec. Rev.*, July 14.

Central Stations in Great Britain.—Brief tables of statistics giving the date and kind of current used. There are now in operation 146 and under construction 84, besides 86 for which provisional orders have been granted.—Lond. *Lightning*, July 6.

REFERENCES.

Central Station Accounting.—HART.—A paper read before the Canadian Electrical Association on central station accounting from a business standpoint.—*Can. Elec. News*, July.

Accounts of Municipal Stations.—STEVENS.—A paper read before the Corporate Treasurers' and Accountants' Institute at Plymouth, England.—Lond. *Elec. Eng.*, July 14.

WIRES, WIRING AND CONDUITS.

Electric Piping.—An editorial summary of the opinions expressed in various communications during the last three months on the subject of electric piping, that is, conduit wiring, some of which have been noticed in the Digest. The correspondence was confined more to a discussion of the relative costs and mechanical advantages of the "Simplex" street conduit and the "Insulating" steel conduit than to the modifications to which the editors had drawn special attention, namely, earthing the outer and using bare copper wire. One great disadvantage of the Simplex tubing was pointed out, namely, that it cannot be bent cold; editorially, however, the opinion is expressed that by properly using the bends supplied with this system any difficulty can be surmounted and that on a 4½-inch wall the Simplex system of pipe systems is the most suitable, as it takes up very little room. The arguments in favor of Simplex tubing were based on the saving of cost in tubing and work, but the other party pointed to the saving in cost of wires by reducing the insulation of the wires. Only one correspondent favored gas pipes as the best system.—Lond. *Elec. Rev.*, July 14.

550-Volt Fuses.—A short note on some recent tests of the fuses, devised by Schirmer and manufactured by the General Electric Co., of Berlin, for 220-volt lamps and 500 to 550-volt motors. A description of the fuses is promised. As source of the current a 1000-hp booster battery of 550 volts was used, the resistance of the leads being only 0.0214 ohm. The source could be short circuited by a 20-amp. fuse, which was thereby subjected to much more severe conditions than ever existed in practice, as the conductors are usually longer and have a higher resistance. Nevertheless the fuse operated quite satisfactorily; for 550 volts there was a moderate noise, for 250 only a slight sound; neither the plug nor the case were injured. For comparison some 100-volt plugs of the old construction were tried and they exploded with a sharp noise at 250 volts.—*Elek. Zeit.*, July 13.

ELECTRO-PHYSICS AND MAGNETISM.

Pressure and X-Ray Ionisation.—HILLERS.—An account of experiments made to investigate the manner in which the pressure of the gas between two plates affects the current which passes when they are brought to different potentials, and X-rays are allowed to traverse the gas. He finds that the moisture of the gas does not affect either the potential or the current intensity, and gives a formula for the potential as a function of the pressure; the potential increases with the pressure. The conductivities of air, carbonic acid gas and hydrogen are in the ratio of 1 : 1.18 : 0.50, but the potential in the case of hydrogen is probably affected by an occlusion of hydrogen in the metallic plates. The ratio of the numbers of ions dissociated in unit volume under unit pressure when under the influence of the same Röntgen radiation is 0.29 : 1 for hydrogen and air. For carbonic acid gas the dissociation is very nearly the same as that of air. —*Wied. Ann.*, No. 6; abstracted in Lond. *Elec.*, July 14.

Instantaneous Radiographs.—CALDWELL.—A short illustrated article on experiments performed to obtain good radiographs with very short exposures, varying from a single discharge to one second. He did not employ any new or unusual methods, but used very efficient tubes and exciting apparatus and developed the negative with care. The exciting apparatus consisted of a good oil-insulated induction coil, capable of delivering a 12 or 14-inch spark, and a Caldwell interrupter giving about 34 breaks per second. The negatives were made on celluloid films, which were laid face down upon a tungstate of calcium screen.—*Elec. Rev.*, July 26.

Capacity of Poor Conductors.—BORGMANN and PETROVSKI.—An Academy paper on researches in which they measured the electric capacity of certain liquids and gas conductors. They found that the capacity of columns of good conducting liquids, is approximately equal to that of equal columns of mercury; this is true for poorly conducting liquids only for columns of small heights; if the height increases the increase of capacity is less in proportion. Columns of insulating liquids have no capacity. The capacity of a tube filled with a rarefied gas, increases as the pressure decreases, to a certain limit; a Crooke's tube has only a very small capacity, equal to that of the electrode. The illuminated part of long tubes increases with an increasing capacity, that is, with a decreasing pressure. The capacity of Geissler tubes in series is less than the sum of their individual capacities. If one end of a Geissler tube placed parallel to another, is connected to earth, both tubes are illuminated.—*L'Ind. Elec.*, June 25.

Corrosion of Iron.—HAMBUECHEN.—A brief abstract of a thesis. The corrosion of iron depends on the physical and chemical character of the metal; he advocates studying the corrosive action by examining the surfaces, producing the corrosion quickly by electric means. The main part refers to an investigation of the energy expended in iron under strain, which increases the tendency to corrosion, as there is then a higher e. m. f. of contact between the iron and an electrolyte. He measured this increase of e. m. f. due to stress and obtained a curve which is similar to the stress-strain diagram, each one showing clearly the point of elastic limit.—*Science*, July 21.

Magnetic Properties of Elements.—MEYER.—Accounts of experiments with the elements themselves as distinguished from solutions of their compounds, the object being to connect their magnetic properties with their atomic weights and the periodic law. He gives a table of atomic magnetisms in which the elements are arranged "in the usual periods" and which distinctly show the dependence of permeability on the atomic. Thus the elements at the beginning and end of each horizontal series are invariably diamagnetic, the paramagnetic elements all being grouped in the middle with a tendency toward the beginning of the series. Sulphur and phosphorus, which are diamagnetic, are the only exceptions to this rule; chlorine really ends the row, but its magnetic qualities are quite unknown.—*Wied. Ann.*, No. 6; abstracted in the Lond. *Elec.*, July 14.

REFERENCES.

Photographing the Electric Effluvium.—ANDREOLI.—After discussing the experiments of others to photograph the spark discharges, he describes at some length his own researches for studying by means of photographs, the silent electric effluvium in a dielectric between the metallic plates of a condenser; some of the photographs are reproduced. He believes that it is the first time an attempt has been made to study this ozone producing discharge in this way. No conclusions or deductions seem to be given.—*L'Elec.*, July 1.

Thermo-Electricity.—LIEBENOW.—A short extract of the article abstracted in the Digest, July 29.—Lond. *Elec.*, July 14.

Reflection of Cathode Rays.—STARKE.—In a recent paper (Digest, March 18) Swinton remarked that the Starke method was not as sensitive as his own. Starke denies this and shows that Swinton did not interpret his results correctly.—*Phil. Mag.*, July.

Luminosity of Rare Earths by Cathode Rays.—SWINTON.—A long abstract of the paper noticed in the Digest, July 1.—*El'ty*, July 26.

Meteorology.—LA GRYE.—Extracts from a report referring chiefly to terrestrial magnetism.—*L'Elec.*, July 1.

Magnetism Illustrated by Air Currents.—WEYHER.—An illustrated description of some experiments for reproducing, by means of rotary movements, all the known properties of magnetism.—*Sc. Amer. Sup.*, July 22.

Magnetism.—EWING.—An illustrated abstract of his lecture, abstracted in the Digest, May 27.—*Sc. Amer. Sup.*, July 29.

Magnetic Survey of the U. S.—BAUER.—A long abstract of the article from *Terrestrial Magnetism,* noticed in the Digest, July 22.—*Sc. Amer. Sup.,* July 29.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolysis of Chlorides of Alkalies.—FOERSTER.—A long paper read at the recent annual meeting of the German Electrochemical Society, giving an account of extended researches by Mueller, Foerster and Jorre to investigate the reactions which take place in such electrolysis. The essential points of the investigation, which was more of a chemical character and is described in detail with the aid of diagrams and tables, are summed up as follows: In the electrolysis of hypochlorite, the chlorate is formed at the anode. As can be shown by a purely chemical investigation, this chlorate can be formed only with the aid of hpyochlorous acid, which therefore must have been formed at the anode; hence in the electrolysis of a neutral solution of chlorides of alkalies, there must be an acid layer at the anode, no alkali as Haber supposed, and therefore the reactions in the electrolysis of neutral and of alkaline solutions of chlorides of alkalies must be different. The following recommendations are made concerning the electrolytic production of the chlorate: The suppression of the cathodic reduction (for instance, by the formation of milk of lime, when chloride of calcium is used); slight acidifying of the solution in order to form free hypochlorous acid; the use of sufficiently large volumes of solutions, relative to the current intensity, and effective stirring of the electrolyte; the use of temperatures of at least 40° C.—*Zeit. f. Elektrochemie,* July 6.

Zinc Extraction.—KERSHAW.—The conclusion of his article on the electrolytic methods (Digest, July 29). He discusses the Cowper-Coles, the Hernck and the Swinburne sulphide ore processes and concludes that "so far as information is available relative to the above wet extraction processes, only two of the six have proved successful when operated upon an industrial scale, namely, the Hoepfer and the Dieffenbach processes; and if Peters' statement regarding the cost of operating the latter process be correct, the number of successful processes is reduced to one." The Hoepfner process is specially designed for the treatment of poor zinc ores in connection with ammonia soda works, and by the aid of this process the chlorine of what has hitherto been a waste product of these works is to be rendered available for the manufacture of bleaching powder. In the Dieffenbach process, a zinc-holding pyrites, useless for either acid making, or for iron smelting, is the raw material; and not only is this ore rendered serviceable for iron production, but chlorine is again obtained as a valuable by-product. The economic success of these two processes is therefore largely due to the value of the constituent liberated at the anode.—Lond. *Elec. Rev.,* July 14.

Electrolytic Preparation of Fluorine.—MOISSAN.—As the platinum vessels which he formely used were attacked, he tried copper, but found it became coated with *fluoride* of copper, which prevents the metal from acting as an electrode; he therefore retained the platinum electrode, but the electrolyte, consisting of anhydrous hydrofluoric acid rendered conducting by potassium fluoride, is placed in a copper vessels which he formerly used were attacked, he tried copper, but a capacity of 200-cb.cm.; with 15 amperes at 50 volts, the output is 5 liters of gas per hour; the duration must not exceed 6 or 8 minutes, as the liquid soon becomes heated and the vapor carries off large quantities of acid even if cooled. Important investigations requiring a continuous current of fluorine gas, are now made possible.—*Comptes Rendus,* 126; abstracted briefly in Lond. *Elec.,* July 14.

Accumulator.—The Vuillot process of making plates is to be used in a factory to be constructed at Brussels. The lead plates are exposed to carbonic acid gas which transforms the surface as completely as desired into carbonate of lead; they are then placed in an alkaline bath, as in a solution of ammonia, for instance, where they are subjected to the "secondary influence of electrolysis" which in a few hours gives the plates their desired qualities. Such plates are claimed to possess great strength and durability.—*Elek. Rundschau;* abstracted briefly in Lond. *Elec. Eng.,* July 14, and N. Y. *Elec. Rev.,* July 26.

Accumulators.—MUELLENDORF.—An abstract of a paper read before the Union of German Engineers, on the practical use of accumulators. Careless handling or ignorance as to how they should be handled by those in charge, can be overcome by proper rules. The presence of foreign matter in the acid can be prevented by examination of both the water and the acid before they are used; special care should be taken to have no chlorine in the acid. The batteries should be protected from violent mechanical concussions by providing them with proper elastic cushions.—*Elec. Tech.,* June 30, and Lond. *Elec. Eng.,* July 7.

REFERENCES.

Accumulators.—BAINVILLE.—The first part of an illustrated report of the prize competition for accumulators offered by the Automobile Club of France, the programme of which was abstracted in the Digest, Jan. 7 and 28. The method of connecting the batteries for charging and discharging, with the instruments, as devised by Hospitalier, is illustrated and described. No conclusions or results are given in this part.—*L'Elec.,* June 24.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Wehnelt Interrupter.—LAGRANGE.—An Academy paper describing a modification of this instrument. In the ordinary form the interruption takes place at the positive electrode, which is usually made of platinum, and in course of time is consumed; he therefore endeavored to obtain the same phenomenon at the negative electrode where hydrogen is evolved, and therefore a cheaper metal such as iron or copper can be used; there is practically no consumption of this electrode. His cathode is made of small copper rods riveted to the lower edge of a broad copper strip which is placed in a vertical position outside of the liquid, and offers a large cooling surface. The desired results were obtained even with a circuit having no appreciable self-induction, the source of current being a battery. By using instead of the copper plate, a vessel of copper through which cooling water flows continually, he has been able to use the apparatus for currents as high as 40 to 100 amperes with or without self-induction in the circuit.—*L'Ind. Elec.,* June 25.

Laboratory Apparatus for Generating High Voltages.—STRASSER.—An illustrated description of an apparatus which is claimed to be well adapted for the calibrations of voltmeters, for insulation measurements and for all purposes for which small current intensities are sufficient. A battery of accumulators is charged with the aid of a specially devised rotating commutator, so that only one accumulator is charged at a time; all the accumulators being connected in series, when they are discharged. As the electrolyte for the accumulators a 15 per cent. solution of carbonate of ammonium, or a saturated solution of bicarbonate of soda, are used, the cathode is lead, the anode aluminum. These accumulators have a high voltage, but a small capacity. By the use of 10 cells and with a speed of the commutator of 1000 revolutions per minute, a primary current of 0.3-amp. at 104 volts was transformed into a current of 0.0075-amp. at 750 volts, the efficiency being 18 per cent.; a primary current of 0.65-amp. at 98 volts was transformed into a current of 0.15-amp. at 150 volts, the efficiency being 35 per cent. With a speed of the commutator of 500 revolutions, a current of 0.25-amp. at 106 volts was transformed into a current of 0.0067-amp. at 670 volts, and a current of 0.44-amp. at 102 volts into one of 0.12-amp. at 120 volts, the efficiencies being 17 per cent. and 31 per cent., respectively.—*Elek. Zeit.,* July 13.

Hour Meter for Variable Rates.—MAY.—An illustrated description of a composite hour or time meter which registers on a common dial the duration in time during which the current flows in various independent circuits; the arrangement is such that different circuits may be charged for at different rates by registering faster or slower. The arrangement is ingenious, but appears to be somewhat complicated. There is a wheel corresponding to each circuit and it has one, two or more teeth, depending on the rate to be charged; when the current is flowing in that circuit these teeth engage with another tooth wheel driving the registering mechanism, the small wheels being so arranged that no two of them can register at the same instant.—*Zeit. fuer Beleucht.,* June 20.

REFERENCES.

Measuring the Efficiency.—Two communications on the question of how to determine the efficiency of conversion of a small gas engine driven series or shunt dynamo, with change-over switch, if the only apparatus available consists of a voltmeter, an ammeter, a rope brake, a speed counter and a tub with lead electrodes.—Lond. *Elec. Eng.,* July 14.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy Between Balloons.—A note stating that experiments are reported from Vienna in which communications were established between balloons by the Marconi system, one of them was captive and the other free. The results were sufficiently encouraging that the military balloon department, presumably of the

government, intends to carry out further experiments. No other information is given, nor is it stated how the ground connection was made with the free balloon.—Lond. *Elec. Eng.*, July 14.

Electric Clocks.—GIEHNE.—The first part of an illustrated description of the installation of 84 public and private secondary clocks driven electrically by the master clock in the central station in Karlsruhe, Germany. The master clock drives the others by means of alternately reversed current impulses. The cost of the installation was $16,700.—*Elek. Zeit.*, July 13.

REFERENCES.

Multiplex Telephony.—SCHWENSKY.—A long, illustrated translation in abstract of the article noticed in the Digest, Jan. 14.—Lond. *Elec.*, July 14.

Development of the Independent Telephone Business.—CRITCHFIELD.—The beginning of a reprint of the paper read before the Independent Telephone Association.—*West. Elec.*, July 22.

Telegraph Statistics.—Some extracts for Germany and Spain for 1897 from the statistics published in the *Jour. Telegraphique.*—Lond. *Elec. Eng.*, July 14.

Telegraphy in Africa.—An illustrated description of the line from Umtali to Cairo, constructed by the African Transcontinental Telegraph Co.—Lond. *El'ty*, July 7.

MISCELLANEOUS.

Destruction of Nut Grass.—DEWEY.—An answer to an inquiry. He refers to the experiments of Armstrong who killed weeds with currents at 24,000 volts in 1895 on the Illinois Central R. R. (noticed in the Digest at the time). A trial of this method at the Michigan Agricultural College showed that while the tops of perennial weeds such as the Canadian thistle, were killed, the roots in moist earth remained uninjured; this is the main difficulty, as nut grass is propagated by underground tubers. There are other methods of eradicating this kind of grass which he seems to consider preferable.—*Sc. Am.*, July 22.

REFERENCES.

Volta.—An illustrated article describing some of the historical relics at the Como Exhibition, some of which were destroyed by the recent fire.—*Sc. Am.*, July 22; reprinted in the *Elec. Rev.*, July 26.

Electricity for Domestic Use.—BOISTEL.—An account of the Brussels Exposition of applications of electricity for domestic use.—*L'Ind. Elec.*, June 25; *L'Elec.*, July 1. Another account is given in the *Elec. Rev.*, July 26.

Canadian Electrical Association.—A very full account of the proceedings of the ninth convention, noticed in the ELECTRICAL WORLD AND ENGINEER, July 8; the papers are reprinted apparently in full.—*Can. Elec. News*, July.

New Books.

PHOTOGRAPHIC OPTICS. By R. S. Cole, M. A., Assistant Master Marlborough College. New York: D. Van Nostrand Company. 330 pages, 102 illustrations. Price, $2.50.

Though a number of works on photography have treated of its optical principles to a greater or less extent and the subject has been frequently discussed in photographic year-books and periodicals, yet in no instance has the discussion been satisfactory. The author very justly states (Introduction) that "writers on optics have for some occult reason deemed it necessary to surround the simplest optical matters with a cloud of symbols repulsive to those who are not mathematically minded, or to leave out all the mathematics, and with it all definiteness and accuracy of expression, which causes even worse confusion than symbols."

This book does not merely commend itself to the physicist and the picture-loving amateur, but it has an especially technical value. Besides the employment of photography for purposes of illustration and general record, it becomes technically important for reducing and copying plans, drawings and specifications. Then, too, for purposes of physical investigation constant recourse is had to photographic processes; among other things, in such cases, the action of a shutter frequently requires to be known with great exactness.

While the work is generally descriptive, each topic receives, where desirable, a thorough mathematical discussion, yet this is done so simply that only algebra, geometry and the barest elements of trigonometry are employed. The writer has evidently been embarrassed by the continually reiterated demand for the non-mathematical discussion of scientific subjects, into explaining the meaning of π (page 17), though he has already assumed that his readers are familiar with geometry; it is apt to make the writer either fall into mild inconsistencies or become patronizing.

In particular, the treatment of the elementary properties of the lens is clear and satisfactory and easily read with the aid of the diagrams; and those who find it necessary to calculate and design a lens for some particular work, will find the details of the process so practically developed that success is assured them. The chapter on the testing of the lens is equally thorough and practical.

One of the most satisfactory chapters is that dealing with exposures, stops and shutters, both the operation and the testing of the latter being fully discussed. Notwithstanding numerous popular articles in the literature of the subject, the time relations in the action of the curtain and concentrically-closing shutters are still very obscure to the general reader. This chapter contains, probably, the best discussion yet given this subject. However, the non-mathematical reader will be at a loss to understand the equations on page 264, where the density of the exposure is given as a logarithmic function of the time. These equations are introduced with the mere statement that such relations were both from theory and experiment. While the derivation would have necessitated the application of the integral calculus, yet they are given without any reference where the unfamiliar reader may obtain their derivation. This is a matter so continually overlooked by writers that attention should be called to it. Were more care bestowed on such details, much of the prejudice against mathematical or symbolical statement might be overcome.

The author seems to have anticipated the optical questions and details which arise in applied photography, and has treated each practically and precisely. The book is a clearly and pleasantly written exposition of the physical and geometrical optics of the lens and its appurtenances and the optical properties of the camera.

BOOKS RECEIVED.

THE ELEMENTS OF PHYSICS. For use in High Schools. By Henry Crew, Ph. D. New York: The Macmillan Company. 347 pages, 266 illustrations. Price, $1.10.

Electric Gas Lighting Attachments for Candle Burners.

Of the various devices used for igniting gas jets, those in what are known as "imitation candle burner" are the most difficult to apply. It is impossible for the manufacturer to carry them in stock, for the reason that the chandeliers supplied with such candles differs from one another in the same house, in external appearance,

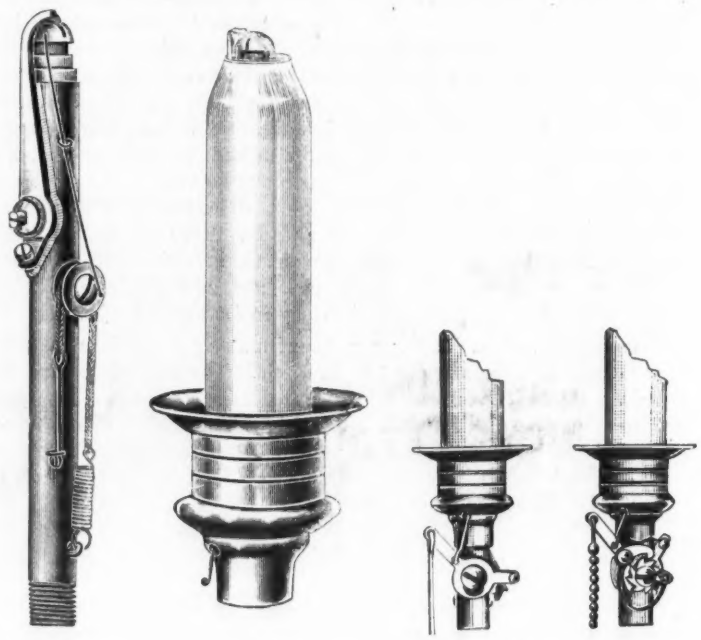


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

and form of candle, they varying to suit the peculiar ornamentation and style of the fixture itself. Again, frequently only a part of the candles on a fixture are to be electrically connected, but they must all correspond, when finished. They must therefore be taken

from the fixture, and the electrical attachments applied to each separately.

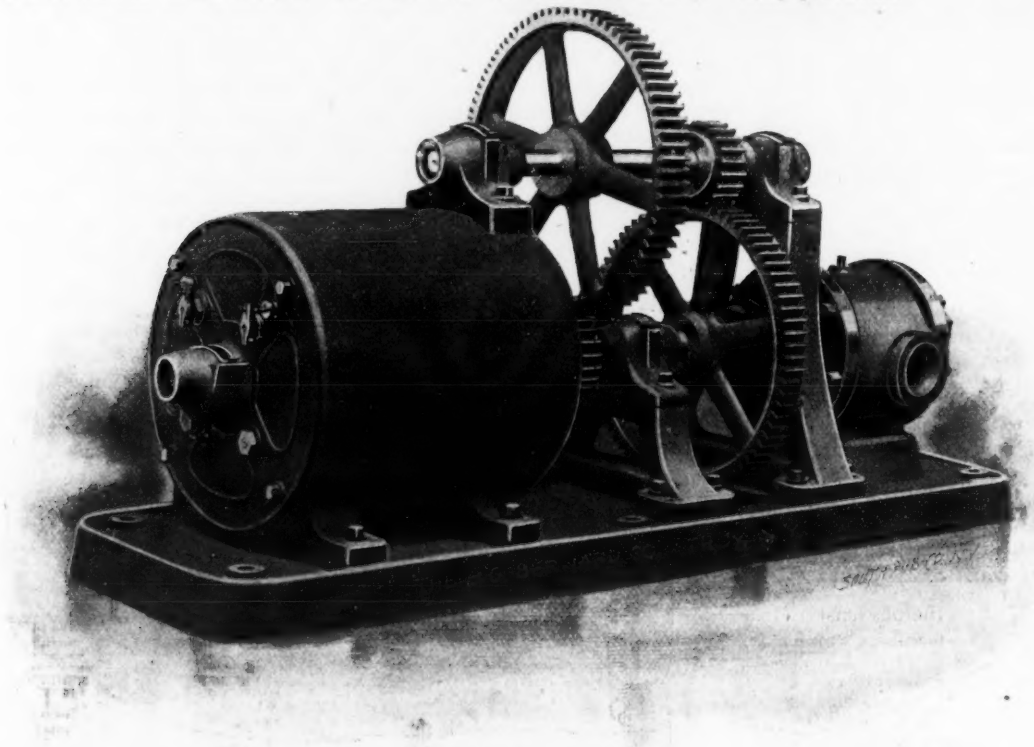
These burners consist of a sconce, or metal shell, and a brass stem passing up through the centre, carrying the tip. Over this stem is slipped the porcelain candle, frequently extremely small and irregular, as to its interior. The operating mechanism for producing the spark must be attached to the brass stem, in this cramped space, and still be free to move readily without sticking, or short circuiting, but permitting of the taking off and on of the candle at any time.

Fig. 1 represents the method of fitting adopted by the A. L. Bogart Company, of 123 Liberty Street, New York. The fixed electrode is secured to the upper part of the stem by a screw, insulated from the electrode by a special bushing. The electrode is so curved that its interior portion clasps the circumference of the stem, but a heavy mica non-conducting piece extends upward the entire length of the electrode to the tip between the former and the stem, thus not only perfectly insulating the electrode but preventing it from shifting its position. The pulley wheel carrying the movable electrode wire is secured by a brass screw, thus obviating any possibility of rust causing the pulley to stick. Although there is no pinching or hammering together of the stem to accommodate the pulley wheel, the parts are so compact that the smallest porcelain candle used may be readily slipped over them.

Fig. 2 shows one style of completed burner. Figs. 3 and 4 are respectively candle burners using the same form of stem, but fitted in the first case with a stop-cock operated by a stiff pendant wire, and in the second a ratchet cock acting by alternate pulls on a chain. This company also fits candles with a particularly small and neat automatic attachment operated by a push button.

Bernard Electric Pumping Outfit.

The electric pumping outfit shown in the accompanying illustration is especially designed for pumping purposes in mines, breweries and similar places, and, if desired, can be so arranged in connection with an automatic circuit breaker that at any time when in use it can be shut down by simply putting a kink in the rubber hose supplied from it. The pump will supply hose up to 3 inches, which is also the size of the suction. The discharge for breweries usually



ELECTRIC PUMPING OUTFIT.

consists of either two or three 1½-inch hose, a larger discharge rarely being used in brewery work.

As will be noted, the motor is of the Bernard enclosed type. The gearing is so mounted as to take up a minimum of space, and the mechanical combination, including a common bed plate, is such as to secure the greatest smoothness in running. The manufacturers are the E. G. Bernard Company, Troy, N. Y.

The "Petite" Alternating Enclosed Arc Lamp.

The alternating enclosed arc lamp illustrated herewith is claimed to be in many respects a radical departure from former practice in this field, and as embodying, both mechanically and electrically, the most advanced features entering into the makeup of an economical and reliable lamp.

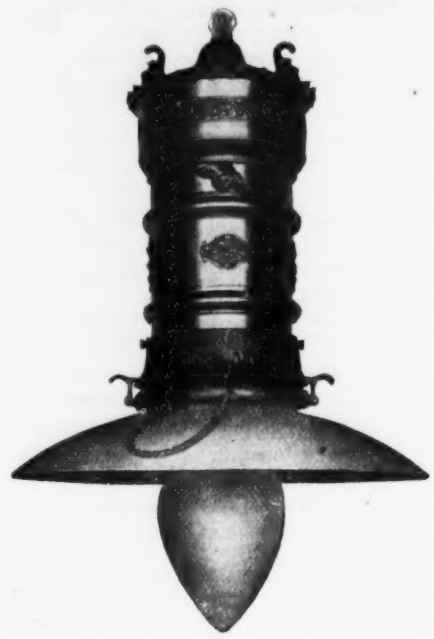


FIG. 1.—PETITE ALTERNATING ARC LAMP.

In the regulating mechanism an induction armature of aluminum is used, so combined with the laminated core of the electromagnet that great range of adjustment is secured and the lamp will continue to burn steadily under wide changes in voltage. The carbon is fed directly by a specially designed clutching mechanism which, while giving great precision of feeding will not allow the carbon to slip through when jarred, or by reason of the mechanical vibrations communicated to it from the mechanism. This is a most desirable feature and one which has long been sought for. A simple mechanical balancing of the moving elements in the lamp mechanism reduces to a minimum the electrical energy necessary to effect regulation, with a resulting high efficiency in the lamp. A particularly noteworthy feature of the lamp is the arrangement of the side arms which support the lower carbon and its holder. These are so located with reference to each other and to the carbons that flaming of the arc and irregular burning away of the tips of the carbon is said to be entirely prevented.

FIG. 2.—PETITE ARC LAMP.

The lamp is short, neat in appearance, easy to trim and is capable of use with various combinations of globes and shades. It is readily connected for operation in multiple at different frequencies, with simple means of adaptation for voltages varying from 100 to 120. It has a life of 100 hours with each trimming and is practically noiseless in its operation. When used for outdoor illumination, no hoods are necessary, a special weatherproof casing being provided, so con-

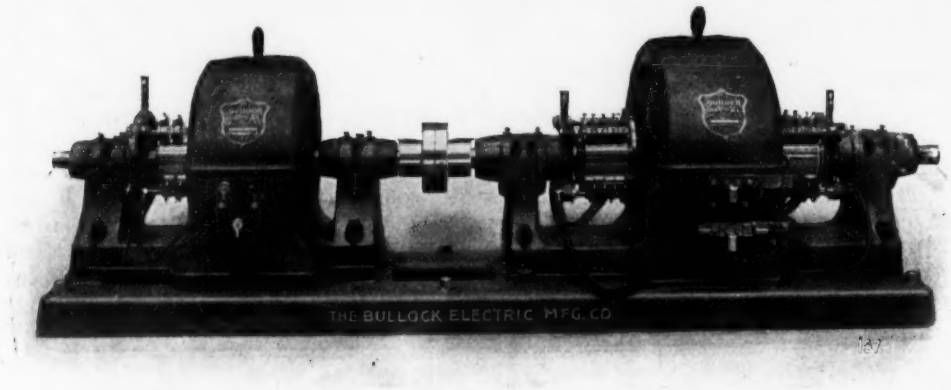
structed that the lamp can be used with a metal reflector, white enameled on the under side in order to throw the light downward; or with an outer globe, with or without a reflector. The inner globe does not require cleaning except at each trimming. This new lamp is manufactured by the Western Electric Company.

Storage Battery Booster.

The Bullock Electric Manufacturing Company, Cincinnati, O., have recently shipped to the La Capital Company, Buenos Ayres, S. A., a booster to be used in connection with the extensive electric system of this company. The accompanying illustration clearly shows the general features of the machine, which consists of a 100-hp motor adapted to use current from the railway feeders varying in pressure from 550 to 650 volts. At the latter pressure the speed is 1000 r. p. m.

The generator, which has a double commutator and is compound wound, has a capacity of 1000 amperes at 60 volts or 500 amperes at 110 volts. Provision is made at the switchboard for using the shunt and series coils separately, the series winding giving a pressure of 60 volts, while the shunt winding produces 110 volts. The machine is equipped with shaft oscillator which is of the automatic magnetic type.

The machines are rigidly connected by a flanged coupling and mounted on a heavy iron subbase, which results in perfect alignment. We are informed that while under test, in the presence of the purchaser's engineer, this machine was shown to possess a perfect electrical and mechanical balance and to run cool throughout its several parts. This is the second booster the Bullock Electric Manufacturing Company has furnished the La Capital Company.



STORAGE BATTERY BOOSTER.

The Riker Demi-Coach.

A very handsome newer type of vehicle that has been a good deal in evidence around the City of New York during the present spring and summer is the Riker demi-coach herewith illustrated. It is interesting in many ways and more particularly as showing a standard form of carriage subjected to the new conditions of evolution due to the abolition of the horse and the use of self-contained motive power. This is probably the first coach or demi-coach in which the driver has been placed, as in a hansom, at the back of the occupants of the vehicle, leaving the view entirely unobstructed. The result is that as one sits in the luxurious interior, the bustle of the street or the passing scenery is presented like a picture within a frame or as if seen from the window of a house or store. The effect is indeed far more satisfactory than is secured with a hansom, because of the greater sense of security. In a hansom nothing but the dashboard intervenes as a protection to the passenger. In this Riker demi-coach, a large part of the battery is put in the box in front serving as a very solid bulwark and putting a greater distance between the passenger and any vehicle or person that might chance to collide.

The Riker demi-coach weighs complete 4200 pounds and has a carrying capacity for 4 passengers in addition to the operator or coachman. Its wheel base is 89 inches, its front tread 54 inches, and its rear tread 61 inches. It is fitted with solid tires 2½ inches by 36 inches in front and 42 inches in the rear. There are two motors of 2-kw capacity each. The controller gives three speeds ahead and two to the rear. A maximum speed of ten miles an hour can be made, and a total run of 25 miles on each charge of the battery on fairly good level macadam. The driving is effected from the

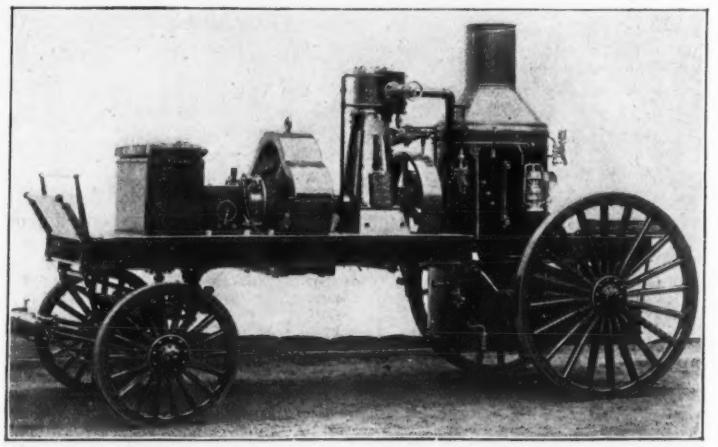
ELECTRIC DEMI-COACH.

rear wheels, and the steering by the front wheels. A combination voltmeter and ammeter is furnished for the motorman, and a gong, and there are electric side lights. All told, the carriage is a most attractive and effective innovation and indicates the manner in which to grapple with the later problems of vehicular pleasure traffic.

Portable Lighting Outfit.

Although isolated plants are now to be found everywhere, and the circuits from central stations are ubiquitous in their ramifications, there often arise emergencies when a portable plant is urgently needed. In fact, there are many conditions under which such a plant may be in steady demand. It thus happens that apparatus of this nature, while not a staple of trade, is often asked for, and in its arrangement the designer has an excellent opportunity for the display of skill, it being evident that "portable" is a word with many severe limitations when it comes to actual practice.

The accompanying illustration represents an ingenious portable lighting outfit, the dynamo of which was built by the Onondaga Dynamo Company, of Syracuse, N. Y. It is direct-connected to a Shepherd upright engine, the latter, together with the boiler and truck, being built by the American Fire Engine Company, of Seneca Falls, N. Y. The dynamo is of the Onondaga Dynamo Company's "Clover Leaf" type, and is especially adapted to this class of service. The American Fire Engine Company has already sent out several of these outfits, which are said to be meeting with much favor.



PORTABLE LIGHTING OUTFIT.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was a period of general recovery in spite of the inactivity due at this season of the year. The depressing effects of the street railway strike proved evanescent, while better crop reports removed many apprehensions as to the future of wheat and corn. During the week 2189 shares of Western Union were dealt in closing the week at 90⅜. General Electric made a brilliant demonstration, and on sales of 25,725 shares rose to 125, closing at the record figure of 124¾. Large orders, the dividend rate and better profits were all ascribed as a reason. In street railway stocks, Brooklyn Rapid Transit was but fairly active, and on dealings for the week of 81,237 shares, closed at 116⅛, a gain of 1. Metropolitan was dull on 10,035 shares around 212, and Manhattan Elevated was slightly higher, up to 118⅜, on 17,285 shares. In Philadelphia, Electric Storage Battery common was quoted strong at 152 to 153, and preferred at 155 to 160; Electric Company of America at 17⅞ bid; Pennsylvania Manufacturing Company at 24½ asked; Philadelphia Traction, at 99¼ bid; Union Traction at 42⅛. In Boston, American Bell Telephone was firm at 347 to 350; Erie Telephone, 96 to 97; Michigan Telephone, 98 to 100; Westinghouse, 48½ to 50; Boston Elevated, 110½; West End, 95, preferred 112 to 114. In Chicago, there was very little done in National Carbon; Lake Street Elevated closed at 17½; Union Traction at 30 common, and 83 preferred. Outside securities for the week in New York were rather languid. Electric Vehicle, common, was quoted at 98 to 102; preferred 115 to 125; Electric Boat, 12 to 16, preferred 45 asked. New York Electric Vehicle Transportation, 22⅜ to 22⅝; New England Electric Vehicle Transportation, 10⅛ to 11; Illinois Electric Vehicle Transportation, 5½ to 6; General Electric Automobile, 12 to 15; General Carriage Company, 34 to 37; International Power, 76 asked for preferred; Otis Elevator, common, 34 to 36; preferred, 92 to 94. No changes are noteworthy in miscellaneous traction and telephone stocks.

MASSACHUSETTS.—The Railroad Commissioners have issued a number of orders on matters which have been subjects of recent hearings. The East Taunton Street Railway Company is permitted to issue capital stock to the amount of $60,000, in addition to $50,000 already issued, for building an extension in Taunton, Lakeville and Middleboro. The board approves an issue of $30,000 five per cent. twenty-year bonds by the Webster & Dudley Street Railway Company, for funding floating debt and building an extension. The Commonwealth Avenue Street Railway Company may increase its capital by $34,000, in addition to $258,000 now authorized, for an extension from Newton Centre to Newton Highlands, and electric equipment of rolling stock. The Needham & Boston Street Railway Company is allowed to issue $50,000 capital stock ($10,000 original, $40,000 increase) to pay and capitalize its debt incurred in building and equipping its railway. The Amesbury & Hampton Street Railway Company are also allowed to issue $50,000 capital stock ($40,000 original, $10,000 increase) for funding the debt incurred for building. The Railroad Commissioners have authorized the Hanover Street Railway Company to issue $690,000 stock, $602,400 to be used for the exchange of the shares of companies consolidated by the Hanover Street Railway Company, and $87,600, for floating funding debt. The petition asks for $691,700 stock. The Commissioners also authorize the company to issue $161,000 20-year 5 per cent. bonds, subject to prior lien of $429,000 first mortgage bonds now outstanding. The petition asks for $251,000 bonds.

CONSOLIDATION AT ROCKFORD, ILL.—An important electric lighting deal has just been put through at Rockford, Ill., in the consolidation of the Forest City Electric Light & Power Company, the Rockford General Electric Company and the Rockford Electric Light Company. The new company will have $250,000 of 5 per cent. bonds, first mortgage, and $50,000, 5 per cent. second mortgage, and $350,000 in stock. The Forest City is one of the oldest Edison companies in the country, and has done a large amount of work all on the three-wire system except the series arc lighting. The other two companies are high tension. All the plants will be consolidated in a joint water power and steam power station on the property of the Rockford General Electric Company, under the supervision of B. J. Arnold, the total capacity being now about 600 arcs, 750 to 1000-hp of motors and 25,000 to 30,000 incandescents, with a gross revenue rising $90,000 a year. With regard to city lighting, the city owns the poles and wires, and the Edison Company gives the service at $51.50 per lamp per year. The new company acquires some very valuable property, and owns one-quarter of the water rights of the Rock River. The deal has been quietly engineered by Mr. Samuel Insull, who becomes chief owner with Mr. M. A. Beal, who has been manager of the Forest City Company for eleven years

REPORT BOSTON ELECTRIC LIGHT COMPANY.—The annual report just issued by President Gilbert gives the following figures:

	1899.	1898.	1897.	1896.
Gross income	$910,892	$809,943	$759,643	$660,973
Operating expenses	604,972	513,409	485,498	420,641
Profits	305,919	296,535	274,145	240,331
Interest charges	53,522	70,393	63,242	50,319
Net for stock	252,397	233,453	218,644	190,012
Dividends	143,908	102,000	110,500	136,000
Surplus	108,489	131,453	108,144	54,012

At the annual meeting, to be held Aug. 8, stockholders will vote on a new issue of $500,000, bringing stock capitalization up to $3,000,000. President Gilbert notes the new work in centralizing apparatus, and claims the lowest cost per kilowatt of output. He says: "We have decided to connect all our circuits in the city proper with our new station, a distance of from one and a half to two miles, involving an expense of $450,000. By doing this we are left free to dispose of the real estate now being used for our generator stations. All station forces are thus concentrated into one station, thereby insuring another large saving."

BUFFALO SECURITIES.—The city of Buffalo is beginning to build high hopes on the Pan-American Exposition of 1901, and the public feeling is reflected in the prices of local electrical stocks and bonds, all of which have been much stronger lately. Quotations of July 15 were as follows: Buffalo General Electric Company, 94; Buffalo Bell Telephone, 175; Cataract Power & Conduit Company, 54; Niagara Falls Power Company, 85. Bonds: Buffalo Traction Company 5s, 109½; Buffalo General Electric Company 5s, 109½; Cataract Power & Conduit Company 5s, 103; Buffalo Railway Company consol 5s, 118½; International Traction Company subs, 114½; Niagara Falls Power Company 5s, 109½. There is reported considerable buying of Niagara Falls Power securities at the best prices.

GENERAL ELECTRIC.—The advance to 124-5 is spoken of as follows in a special from Boston: The advance in General Electric is on large earnings and a prospective increase in dividends. We are informed that the company is now showing earnings of 20 per cent. on the common stock. The company paid its first common stock dividend May 22 at the rate of 6 per cent. Talk is that this rate will be continued and extra dividends be declared as earnings warrant.

NEW ENGLAND TELEPHONE.—New England Telegraph & Telephone Company has declared the regular quarterly dividend of $1.50 per share, payable August 15.

CHICAGO EDISON COMPANY has declared the regular quarterly dividend of 2 per cent., payable August 1.

Commercial Intelligence.

THE STATE OF TRADE.—The summer is not usually an active period in electrical industries, but the growth of export business is coming in to equalize conditions more thoroughly the year around. It is quite natural that comparatively few arc or incandescent lamps should be needed from June till September, while, on the other hand, one does not expect to see much trolley or subway construction between November and March. But taking the electrical trade as a whole, it is vastly different from what it was when there were no fan motors to sell briskly in the dog days; when there was no heating apparatus, and when independent telephony, wireless telegraphy, Röntgen ray work, and a score of other "side shows" were quite unknown. And now an expanding export trade has come in to keep our manufacturers busy the year round. Many of them are slackening up a bit to overhaul machinery, put in new plant or for mere rest, but they are still booking orders and feel hopeful as to the fall. A good deal of apparatus is reported to be going into the mining districts, and general inquiries are excellent. Crop conditions are quite bright. The volume of payments through the Clearing House is 47.2 per cent. better than last year, and railroad business for July is the best of the year, being 16.1 per cent. better than last year, and 10.4 per cent. better than in 1892. In the metal market copper is strong at 18½ cents for Lake, lead weak at 4.55 cents, and tin quoted at 31.75.

ELECTRICAL GOODS IN BRAZIL.—It would appear from official figures that electrical imports at Rio de Janeiro for January and February were $21,000, of which $11,000 was credited to the United States. Discussing electrical affairs in the Republic of Brazil, the French Consul at Rio ascribes the principal work to this country and Germany, and speaking of the concerns engaged says: "The oldest one of these electrical companies actually established at Rio is the General Electric Company, with branches in all the neighboring states. It has for a long time, through its influence and importance of its clientele, dominated the market. To it is also due the establishment of the first telephones and a part of the electric cars of Battete and Santa Thereza. The Germans, however, have lost no time in entering into keen competition with this company. At first a German house, representing Krupp & Schuker, succeeded in putting on the market for the German trade a large quantity of electrical apparatus and machinery, much desired and appreciated on account of their low prices, and in the last three years a new German house, encouraged by the success of the first one, has entered the market with a capital of 5,500,000 marks. This enterprise intends to buy up the electric car lines of Bahia and the telephone service of Rio. Another German company is desirous of obtaining possession of the street car lines of Sao Christovao. A new German electric company, entitled the 'Brasilianische Elektrizitats Gesellschaft,' has been formed in Brazil, and is authorized by a decree of April 7, 1899, published in the *Diario Oficial*, to operate in Brazil. This company, whose headquarters are in Berlin, and which has a capital of 5,000,000 marks, seems destined to absorb all the other German electrical companies, thus forming one large syndicate. The representatives of this syndicate are now negotiating for the purchase of the principal waterfals near this capital, assuring to the projected enterprises all the necessary water power facilities in the future."

ORDERS FOR POWER TRANSMISSION APPARATUS.—English capital is reported to be interested to the extent of $5,000,000 in two new power enterprises, and is already being spent on apparatus for the work. One plant will be near Omaha, the other at Waddington, N. Y. With reference to the Omaha scheme; it is proposed to tap the Platte River at a point 28 miles west of Fremont, carrying the water by means of a canal to a reservoir, which will be 3½ miles long and 1 mile wide. This reservoir will be built on the top of the bluffs of the Platte River. There is a fall in the river of five feet to the mile. The canal will be carried at a grade of one foot to the mile. The power house will be erected at the bottom of the bluffs on the river bank. The water will be carried into the power house, and will give a working head of 110 feet. They expect to generate 25,000-hp, which will be conveyed right into the City of Omaha. The equipment of the power house will consist of 50 turbines, which will be manufactured by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, each capable of developing 500-hp each. The exciters and generators which will be directly connected to the turbine shafts will be supplied by the General Electric Company. The power house plant alone is estimated to cost

$500,000. More than $3,000,000 will be expended in the enterprise. As to the Waddington scheme, a dam and power house will be built across the channel of the St. Lawrence, which is formed by the New York shore and Ogden's Island. The available head will be ten feet. It is proposed to commence by generating 3000-hp; Ultimately 12,000-hp will be utilized for distributing in Ogdensburg, N. Y., and Prescott, on the Canadian side. The initial plant will cost $200,000, and more than $1,000,000 will be required to complete the construction.

BRITISH WESTINGHOUSE PLANS.—The formal incorporation of the British Westinghouse Electric & Manufacturing Company, Limited, is now announced, with a capital stock of $7,500,000, and a heavy over-subscription of the stock. The American Westinghouse Company made a contract a few days ago with the new company, and secures a one-third interest in it. The Pittsburg Company also made a contract on July 10, under which it granted the exclusive right to the British Company to use its patents, drawings and other rights in the British empire save the possessions in North America. The Pittsburg Company further agrees to furnish plans, specifications and patents for improvements for the next ten years. The consideration the Pittsburg Company gets for this is 50,000 shares of common stock. The Pittsburg Company guarantees that the profits resulting from the business for the first two years shall amount to a sum not less than sufficient to pay the preferred dividend. The British Company has obtained, through George Westinghouse, a site on the Trafford Park estate at Manchester, on the Manchester ship-canal, of about 105 acres, and 40 acres of this will be put under roof at once. The buildings will be completed in about 18 months—the steel for their construction to go from Pittsburg. It is understood that Mr. John W. Cloud is to be the president of the new company. He was at one time secretary of the Master Mechanics Association, and more lately connected with the Westinghouse Air Brake Co. He is also known from the Cloud steel truck. The directors of the company are George Westinghouse, Lemuel Bannister, Joseph Lawrence, chairman of the Linotype Co. and of the Machinery Trust, Ltd.; Hon. R. C. Parsons, C. W. Benson, and J. Annan Bryce, lately of the Naval Construction & Armaments Company.

RISING COST OF MATERIAL.—Makers of dynamos and motors are grumbling a little about the fact that prices are not keeping pace with the enhanced cost of material. The subjoined data shows in detail how prices have gone up, the month of July being taken in the two years.

	Price 1898.	Price 1899.	Advance
Cast Iron	$0.02 lb.	$0.02½ lb.	25%
Brass	.17	.25	47%
Arm. Steel	3.10 cwt	3.85 cwt.	24%
Cast Steel	.04½ lb.	.05 lb.	11%
Pole Steel	60—65% dis.	30% dis.	26%
C. R. Steel	2.50 cwt.	3.15 cwt.	45%
Common Copper	.22¼ lb.	.29 lb	30%
Arm. Copper	.16 lb.	.22 lb.	38%
Field Copper	.16—.49 lb.	.22.69 lb.	38—40%
Malleable Iron	.04	.04½	12.5%

Taking specific instances, it is found that in the case of a generator of say 150-kw, the advance in material is $400, with an added 10 per cent. for labor, making a net gain of 26 per cent. in cost. A 50-kw generator shows an increase of 23 per cent., and in material of 31 per cent. But the selling price has not advanced in anything like the same proportion, and a better agreement or understanding all around is desirable.

MORRIS ELECTRIC COMPANY, which has been organized recently by Mr. Elmer P. Morris, will continue the electric railway supply business that has been built up so successfully by that well known pioneer, and should occasion offer will extend the field of operations. The capital is $300,000, and the concern is already doing a business that will turn that over twice a year. Mr. Morris has gathered in the eastern and export agencies of the Electric Railway Equipment Company, of Cincinnati; Garton-Daniels Electric Company; Simonds manufacturing Company; Highland Electro-Chemical Company; Keystone Electrical Instrument Company; Pittsburg Trolley Pole Company; Bailey Manufacturing Company; Bradford Belting Company; Globe Metal Works; McKee, Fuller & Co.; Eastern Carbon Works; Clifton Manufacturing Company; Munder Electric Works; Michigan Manufacturing Company; Seamless Structural Tube Company; National Electrical Manufacturing Company; Spiral Journal Bearing Company; General Equipment Company; Wagenhals Manufacturing Company; Waclark Wire Company and Standard Drop Forging Company. In this country the Morris Electric Company will act as purchasing agent for several foreign corporations and individuals. Outside the above long list, Mr. Morris is in touch with other branches of product, and will push some novelties, including a new rail bond, orders for which already mount up into hundreds of thousands. Mr. Morris says the company has been buying machinery and proposes to do considerable manufacturing on its own account. Its headquarters will continue to be at 15 Cortlandt street.

WESTINGHOUSE APPARATUS FOR CHINA.—It is reported that the Westinghouse Electric & Manufacturing Company, and its kindred interests, have been awarded the entire contract for the equipment of the numerous electrical plants which will be installed on the Chinese Eastern Railway. The contract at present calls for the immediate delivery of three temporary electric lighting plants, each comprising 15-hp, 20-hp and 60-hp Westinghouse dynamos, driven by Westinghouse Machine Company's engines. One equipment is intended for the principal machine shops of the road, which are now being temporarily built at Harbin, Manchuria. The other two will be utilized for night work on bridge building and other construction purposes on the Port Arthur section. One hundred and five arc lamps have been ordered from the Manhattan General Construction Company, of New York, and several thousand incandescent lamps will be supplied by the Sawyer-Mann Electric Company, which company practically belongs to the Westinghouse interests. The several switchboard apparatuses, and all the necessary accessories will be furnished by the Westinghouse Company. The shipments about to be made are estimated to be worth some $40,000, but, as the apparatus now ordered is only for temporary work, the Westinghouse people assume that quite $200,000 will ultimately be involved in the contract. The details of the orders now pending shipment were arranged by V. Kishevitch, the electrical expert of the Chinese Eastern Railway, who is in this country at present. The contract was ratified by V. A. Kishevnikoff, the chief engineer of the mechanical department of the road, on the eve of his departure for Manchuria.

THE STANLEY APPARATUS.—In a recent interview in the Pittsfield, Mass., Journal, Mr. William Stanley made a very interesting survey of the successful work done by the Stanley Electric Manufacturing Company and of his own large share in the development of the alternating current field since he erected his pioneer machine at Great Barrington in 1885-6, and suggested a little later to Messrs. Gamwell and Whittlesey the good opening that presented, leading to the initial investment until not less than $413,000 had been put in and used to excellent advantage. As to the business at the present time, Mr. Stanley said: "The output for the past year, and this is a very conservative estimate, is as follows: Alternating generators and motors in use, 120,000-hp; transformers, 750,000 lights capacity; meters, 450,000. These three items alone approximately represent $3,000,000 capital, while the other items which go to make up the system will easily bring this amount to $5,000,000. Of this amount the Stanley Electric Manufacturing Company have been doing a business of from $500,000 to $600,000, not because of their inability to obtain the business, but because they were not properly equipped with shops and facilities to allow them to bid for the major part of the work. There has not been a month, a week, or a day, in the past three or four years, when the Stanley Electric Manufacturing Company could not have employed 1000 skilled workmen in the lines of manufacture in which they were well posted, and to a certain extent equipped."

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material, etc., are from the port of New York for the week ending July 25: Antwerp—50 cases electrical material $1122. Argentine Republic—246 cases electrical material $9556. British West Indies—10 packages electrical material $263; 11 cases electrical material $418. Brazil—1 package electros $15. British Elast Indies—25 cases electrical material $1084. British Australia—30 packages electrical material $976. China—16 cases electrical machinery $515; 3 cases electrical material $135. Chili—1 case electrical material $28. Cuba—45 packages electrical material $970. Central America—74 package electros $15. British East Indies—25 cases electrical material $1084. Havre—20 cases electrical machinery $750. 39 packages electric heating material $1607. Japan—37 cases electric material $2434. Liverpool—231 packages electrical material $10,915. London—177 packages electrical material $4844; 7 crates electrical machinery $1620; 5 packages electric motors $200. Mexico—51 packages electrical material $2345. Odessa—27 packages electrical material $1195. Porto Rico—7 cases electrical material $117. Peru—35 packages electrical material $427. Rotterdam—4 cases electrical material $94. Southampton—2 packages electrical material $125; 62 packages electrical machinery $1174; 6 cases electric cars $1200. Siam—20 cases electrical material $115; 1 package electrical material $189. U. S. of Colombia—21 packages electrical material $317.

BALTIMORE AUTOMOBILE AND MANUFACTURING COMPANY represents the interest taken in Maryland in automobilism by the business community. All the capital of $1,000,000 seems likely to be taken up to the full limit. The following officers have been elected: President, John Kuper; vice-president and general manager, Joseph M. Zamoiski; secretary and treasurer, Thomas P. Amoss; counsel, W. Irvine Cross; chief electrical Engineer, W. W. Donaldson. The company was incorporated with a capital stock of $100,000, divided into 10,000 shares of $10 each, with the privilege of increasing the capital stock to $1,000,000. The purpose is to manufacture and dispose of automobile vehicles and also to operate them. The company has bought a factory at 872 Park avenue, running through the square to Howard street, giving a carriage entrance each end, and the building is four stories in height, measuring 50 by 200 feet. This will be equipped with tools, machinery, etc., a repair shop, an isolated charging plant, etc. The company has acquired the exclusive agency for Maryland for the Waverley automobiles of the Indianca Bicycle Company, and has orders in hand now for $30,000 of vehicles. A bus route has been selected, and the establishment of a cab system and a parcel delivery system is contemplated. The electrical engineer of the company, Mr. Donaldson, will be remembered by his well-known work in storage batteries, motors, etc., of a few years ago.

SOME EXPORT FIGURES,.—The total increase in our exports of manufactures during the year, as shown by the figures of the Treasury Bureau of Statistics, is in round numbers $48,000,000, and of this increase $33,000,000 is in manufactures of iron and steel. The total exports of iron and steel and manufactures thereof in the fiscal year 1899 were $93,715,951, against $70,406,885 in 1898, $57,497,872 in 1897, $41,160,877 in 1896, $32,000,989 in 1895, and $29,220,264 in 1894. It will thus be seen that the exports of manufactures of iron and steel in 1899 were more than double those of 1896, and more than three times as much as those of 1894. On the other hand, the imports of manufactures of iron and steel continue to fall, having been during the year but $12,098,239, against $25,338,103 in 1896 and $53,544,372 in 1891. All the classes of manufactures of iron and steel have shared in the growth of popularity abroad, but this is especially marked in the higher grades of manufactures, such as steel rails, railway engines, builders' hardware, machinery of all sorts, and especially those used in manufacturing. The total figures for electrical machinery exported in 1899 are $2,736,110, as compared with $2,052,564 in 1898. Steam engines are $1,481,523, as compared with $1,333,619, and pumps and pumping machinery $2,710,654, as compared with $2,023,034.

INDEPENDENT TELEPHONE MANUFACTURE.—As the weeks go by, the prospect of the consumation of the deal for consolidating some of the larger independent telephone manufacturers seems to fade away into the dim distance of failure and impossibility. Among those who were interested there is manifested in various quarters not a little feeling on the subject. The gist of the complaint from influential parties is as follows: "The attempt to bring the manufacturers together has done harm in turning down business that would have been done this summer. We should have taken orders, enlarged our plant, bought new tools and supplies, and would have been just that much

further along; but with the uncertainty of a possible consolidation hanging over us, nobody could well transact business of any important magnitude. The effect has been bad, and there is no compensating advantage. On the contrary, the little fellows have been making hay while we leaned on our rakes; and what is worse, we have shown up our books, our costs, etc., to competitors and revealed methods and data that are part of the stock in trade of every manufacturer. Besides, the fact that capital does not show itself prompt to take up the scheme and endorse it, is not helpful to independent telephony, to say the least."

AUTOMOBILES IN NEW ENGLAND.—The success of the electrics at Newport has caused a great rush on the manufacturers, who have been swamped with orders from that fashionable resort. In Boston, the Edison Electric Illuminating Company has obtained practically a five years' exclusive contract for the entire city, from the New England Electric Vehicle Transportation Company, an auxiliary service for a small quantity of current being taken also from the Boston Electric Light Company. The New England Company, which is the territorial branch of the parent Electric Vehicle Company, has secured a fine piece of property in the old Boston Cyclorama Building, and is now modeling and equipping it at considerable expense as an automobile charging headquarters, under the supervision of Mr. Neftel.

MICA INTERESTS COMBINED.—The America Mica Company, which has a capital stock of $3,500,000, and which will control a large portion of the output of mica in the United States, has been incorporated under the laws of New Jersey. C. B. Wisner, secretary of the Sills Mica Company, Chicago, when asked regarding the new corporation this week, said: "Three days ago representatives of the Sills Mills Company, Eugene Munsell Company, New York, and the American Mica Company, of Boston, the three largest companies in the United States, met in New York, and formed the combination. Options have been secured on all the smaller companies, and prices will be advanced 5 per cent. September 1, and perhaps more later on."

WESTERN ELECTRIC'S NEW FACTORY.—The Western Electric Company will erect a new ten-story factory at the northwest corner of Washington and Bank Streets, New York city. Plans submitted to the Building Department this week through Architect Cyrus L. W. Eidlitz call for a brick and terra cotta structure on a plot 105 by 140. The new building will cost, according to the present estimate, $450,000. The company's factory is now situated at 57 Bethune Street, not far from the site of the one about to be erected.

ELECTRICAL VEHICLES FOR CHICAGO.—Mr. W. L. Githens, the general superintendent of the Illinois Electric Vehicle Transportation, was visiting New York last week, and reported that his company had placed an order for immediate delivery, with the Electric Vehicle Company for 69 vehicles as a start. Ten are to go forward at once. There are to be 50 cabs and 19 pleasure vehicles of the victoria, runabout and other kinds. Mr. Githens was lately superintendent of the Hyde Park electric light station.

STREET RAILWAY SHOPS.—The work undertaken by many of the street railway systems is now so large as to make them heavy consumers of material and extensive buyers of machine tools. A typical example is the United Railways & Electric Company, of Baltimore, which, in putting up its new barns, etc., embracing more than 70 acres of land in Southwest Baltimore, is to have fine repair shops, etc., and will make provision for building cars.

A LARGE CRANE CONTRACT.—It is understood that Vickers, Sons & Maxim, Limited, of Sheffield, England, have placed a contract in the United States for two electric battleship cantilever cranes and trestles, and two electric cantilever yard cranes for their shipbuilding yards. This will be the largest shipment of cranes ever made to England from this country. The contract calls for 6,000 tons of material, at a cost of about $350,000.

TELEPHONES FOR URUGUAY.—The French Legation at Montevideo has informed the French Government that several projects for the establishment of telephone lines at the State's expense are being considered by the Uruguayan Government. All communications and offers of supplies should be addressed to the "Dirección de Correos y de Telégrafos" at Montevideo.

COAL PRICES ADVANCED.—Announcement has been made by the anthracite companies that all orders for coal at prices prior to July 1 not filled on July 31, will be canceled and the advance of 25 cents per ton will then go into general effect.

NEW YORK NOTES.

New York, Aug. 2, 1899.

NEW YORK EDISON COMPANY.—The Edison Electric Illuminating Company is to erect four fireproof branch stations at No. 211 West 84th Street, No. 128 East 121st Street, No. 258 West 124th Street, and 32 Horatio Street.

HOLLAND SUBMARINE BOAT has been under test by the U. S. Naval Board in Peconic Bay, L. I., and the results are understood to have been very satisfactory. The Holland Company has lately reduced its capital. The boat is to be equipped with Diesel engines.

ELECTRICITY ON BROOKLYN ELEVATED ROADS.—The full electric service over the Fifth Avenue elevated line and the Thirty-sixth Street connection to Coney Island was begun in Brooklyn on Tuesday last. The third-rail system is used to Thirty-sixth street and the trolley from there to the island.

A NEW TELEPHONE EXCHANGE.—The New York Telephone Company has bought the old buildings at 61 and 63 Irving Place, and will soon erect a six-story building on their site, to be used as the central station of the 18th street district. The company paid $80,000 for the property, which has a frontage of 54 feet, and is 100 feet deep. The 18th Street central station is at present in the McIntyre Building, at 874 Broadway.

ILLUMINATION AT THE DEWEY CELEBRATION.—The Committee on Plan and Scope of the Dewey reception celebration at its meeting on July 27 considered a plan submitted by Mr. Lewis Nixon, of the Sub-Committee on Fireworks, for the illumination of the entire city by electric lights during the three nights following the arrival in this country of Admiral Dewey. It was agreed that several points about the harbor ought to be illuminated with special brilliancy, among them the Jersey shore from Jersey City south in order to bring out the outlines of the Statute of Liberty, and the Brooklyn shore for as long a distance as possible, the idea being to have Manhattan form the centre of a brilliantly illuminated theatre. Brooklyn Bridge, it was decided, should be illuminated, and so should Ellis Island.

CONSOLIDATION IN NEW JERSEY.—It was reported from Philadelphia on July 28 that a large gas and electric light deal had just been completed by which the electric companies of Hoboken, Elizabeth and the People's Light & Power Company, controlling the electric light plants in Newark, the Oranges, Montclair, Jersey City, Bergen Point and neighboring towns and villages, had been consolidated. The name of the consolidated company is to be known as the United Electric Company of New Jersey. The consolidation of the electric light properties in Northern and Eastern New Jersey is looked upon as a step in the ultimate consolidation of all the trolley interests with the gas and electric light companies in that section of the State. Bernard Shanley, New Jersey contractor and capitalist, is credited with having brought about the present consolidation. The financing of the deal will be done by the Widener-Elkins syndicate of Philadelphia, which is largely interested in all the New Jersey traction gas and electric light companies. John D. Crimmins, of New York, has also figured prominently in the deal.

NEW ENGLAND NOTES.

Boston, Mass., July 31, 1899.

MR. JAMES L. RUSSELL, of 170 Summer street, Boston, is now representing the George Cutter Company, of Chicago, in the New England States, and will give special attention to the street lighting specialties made by this firm. The George Cutter Company has just brought out some special forms of their devices to suit the New England trade, and Mr. Russell's acquaintance with the central stations in this territory will no doubt enable them to introduce these new devices quite generally.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—The entrance examinations for the Massachusetts Institute of Technology have been held this year at the following points: Albany, N. Y.; Boston, Mass.; Buffalo, N. Y.; Chicago, Ill.; Cincinnati, O.; Cleveland, O.; Concord, N. H.; Denver, Col.; Detroit, Mich.; Exeter, N. H.; Indianapolis, Ind.; Kansas City, Mo.; Louisville, Ky.; Manlius, N. Y.; New York, N. Y.; Philadelphia, Pa.; Pittsburg, Pa.; Portland, Me.; Poughkeepsie, N. Y.; St. Louis, Mo.; St. Paul, Minn.; Springfield, Mass., and Washington, D. C. The total registration, 633, is 78 more than last year, and the largest in the history of the institute. Of these 261 are preliminary applicants for admission in 1900. A continually increasing proportion of applicants divide their examinations between two successive years. Entrance examinations will also be held in Boston in September.

SOUTHERN NOTES.

Memphis, Tenn., July 29, 1899.

A NEW HOTEL, being built by Mrs. Napoleon Hill in Memphis, will be equipped with 40 telephones of the Allen-Hussey make and a complete electric lighting plant.

GENERAL S. T. CARNES, president of the Memphis Light & Power Company, is using an electric automobile. He handles it quite skilfully—like an old hand at the business.

AT MARTIN, TENN., the people are tired of high rates for telephones, and have formed a company, headed by the mayor, Mr. J. E. Kennedy. The company is putting in an exchange with a 200 number switchboard.

THE CUMBERLAND TELEPHONE & TELEGRAPH COMPANY has let the contract for its new exchange building. It is to be three-story and basement. The company will put in a new metallic circuit switchboard, to cost $75,000.

THE CUMBERLAND TELEPHONE & TELEGRAPH COMPANY has closed a deal at Jackson, Miss., for the People's Telephone Company's "lock, stock and barrel." By the contract they agree to maintain old rates of the People's Company for five years.

THE SOUTH WESTERN BELL TELEPHONE COMPANY has adopted a wise plan for the people of the southwest in renting telephones to the independent companies and persons putting in exchanges in small places, charging $6 per annum for telephones furnishing switchboard free. It also gives the local companies 20 per cent. of toll collections.

ELECTRIC LIGHT IN MEMPHIS.—The mayor and Lighting Committee of Memphis have decided after thorough investigation that the tall mast plan for electric lights for the suburbs, will not answer, and have given orders for arc lights to be placed at many of the street crossings outside of the old city limits. These lights are to be 2000-cp and suspended at the centre of the crossings, from 35-foot poles.

THE CUMBERLAND TELEGRAPH & TELEPHONE COMPANY has absorbed the independent telephone exchanges at Scranton and Moss Point Miss., together with several toll lines running out from those places. It is stated that poor construction and service with low rates led to this step. C. M. Huber, president and manager of the Vicksburg independent system, in selling to the same company, gives the same reason.

Baltimore, Md., July 31, 1899.

SUBWAYS IN BALTIMORE.—The Electrical Subway Commission expects to have the system of conduits for the burial of overhead wires in the central part of the city completed by February, 1900. Some time before that date notice will be given the companies required to put their wires in the conduits that they must have their overhead wires removed. The companies have six months to comply with the order. Chief En-

gineer Charles E. Phelps, Jr., of the subway work, has submitted to the Subway Commission a statement showing that the work has been less expensive than similar work in any other city offering similar obstructions to overcome. This reduced cost will be to the advantage of the companies using the conduits, for they will have to pay a rental upon the conduits sufficient in the aggregate to pay the cost of maintenance and provide a sinking fund for the redemption of the $1,000,000 loan for subway construction. It is believed that with proper financiering the cost of the rental of space in the conduits in Baltimore will not exceed from 3 to 4 cents per duct foot. The cost of the whole subway work thus far done is $128,885.30. This is 20 per cent. less than was calculated by the commission at the inception of the work. The money for the subway construction comes out of the $1,000,000 3½ per cent. 1922 loan for that purpose.

PITTSBURG NOTES.

Pittsburg, Pa., July 29, 1899.

THE CONSOLIDATED TRACTION COMPANY of this city has just let a contract to the Keystone Bridge Company for the erection of a bridge across the Allegheny River between Lawrenceville and Sharpsburg, both suburbs of Pittsburg.

ALEXANDER MITINSKY, a Russian electrician and professor of applied mechanism in the St. Petersburg Academy of Mines, is stopping at the Hotel Duquesne, in this city. He has come to America as an envoy from his government to investigate and study the manufacture and cost of American labor saving machinery.

THE MICA MACHINE COMPANY has been organized in this city, and will immediately go to work making these machines. As is well known, the splitting of mica is now done by girls usually, and the invention of this new machine is expected to supersede them, because it will be able to do the work more rapidly and much cheaper than the girls could possibly do it. Messrs. Richard A. L. Snyder, R. Willis Heard and Frank B. Semple, of Sewickly, Pa., are at the head of this new enterprise.

MR. G. F. GREENWOOD, consulting electrical engineer of the Consolidated Traction Company of this city, has just returned from Havana, Cuba, where he has been in the interest of the Havana Electric Railway Company. The latter is an American corporation organized for the purpose of constructing and operating electric railways in and around the city of Havana. Mr. Greenwood will be the general manager of the road. He says that all the material used in the new enterprise will be of American manufacture, and the specifications for the work have already been drawn up, preparatory to letting the contracts.

INDIANA NOTES.

Indianapolis, Ind., July 29, 1899.

A NEW TELEPHONE EXCHANGE has been erected at Franklin, Ind. Frank Jackley and others are the owners. The uniform rate per year is to be $18.

THE DARLINGTON TELEPHONE COMPANY, of Darlington, has fi'ed articles of incorporation with the Secretary of State. Capital stock, $5000. The directors are Daniel Lewis, V. G. Craig, T. M. Campbell, J. A. Paterson, John Paterson, R. C. Dummington, and L. W. Little.

TELEPHONE TAXATION.—The Indiana State Tax Board has sent out an official circular to all telephone companies asking for information as to mileage of wire, income, expenses, value of stock, plant, etc. Every auditor of the 92 counties is asked by circular to give the value placed on these plants last year, and to give an opinion as to the real value of plants respectively in their counties at the present time.

FINISHING THE GREENWOOD ROAD.—Work has been resumed on the Indianapolis & Greenwood electric line between Greenwood and Southport, which was originally begun four years ago. Work was suspended before the grading was entirely completed. John C. Vannatta, of Brookston, is president, and Charles F. Coffin, of Indianapolis, is secretary and treasurer. The officers say the road will be completed and operated before winter.

ANOTHER ELECTRIC ROAD is projected for northern Indiana. George R. Bullard and Charles E. Sawyer, of Marshall, Mich., well known electric railway promoters, are in Michigan City, arranging for franchises and rights of way for the building of a road, via southern Michigan towns to South Bend. The road, if built, will become part of the interurban system projected by an Eastern syndicate to connect northern Indiana and southern Michigan towns.

THE INTERURBAN RAILROAD COMPANY, of Richmond, organized for the purpose of bringing a new line into Richmond, has projected another line between Richmond and Harrison, O. Franchises have been secured through Wayne, Union, Franklyn and Dearborn Counties. The grading of the roadbed will be done this year, but owing to the scarcity of material nothing more is promised until spring. The road is to be equipped for transportation of freight as well as passengers. The distance is 43 miles.

CHICAGO NOTES.

Chicago, Ill., July 29, 1899.

MR. W. H. JACOB, manager of the sales department of the Triumph Electric Company, Cincinnati, Ohio, was in Chicago on a business trip last week.

NEW PRESIDENT FOR CHICAGO STREET RAILWAYS.—Mr. Daniel T. Hunt has succeeded Charles T. Yerkes as president of the North and West Chicago Street Railway corporations. The new president is comparatively unknown to the local world of finance—to Chicago he is a stranger. He has been a resident of Chicago only five years, and is the manager of the Chicago offices of the American Surety Company.

WESTERN TELEPHONE CONSTRUCTION COMPANY.—We are informed that the suit of Madison B. Kennedy against this company, which has been in litigation for two years past, has been decided in its favor by Judge Bretano, of the Superior Court of Cook County. The case appears to have been one in which a dissatisfied stockholder sought a receivership on some ground of complaint, but the Judge is said to have commented strongly on the absence of all foundation for the charges or the action.

ASSESSING RAILWAY PROPERTY.—According to rough estimates made at the Board of Assessors' office it is figured that the total valuation of real and personal property belonging to the Chicago City Railway Company and the West Chicago and North Chicago street railway companies, including all lines entering into the Chicago Union Traction Company consolidation, will approximate $24,000,000, distributed as follows: Chicago City Railway Company—Personal, $6,000,000; real estate, $4,000,000. North Chicago Street Railway Company—Personal, $4,000,000; real estate, $2,500,000. West Chicago Street Railway Company—Personal, $5,000,000; real estate, $3,000,000. Total, $24,000,000. The assigned reason for the advance in the Chicago City Railway Company's assessment is the fact that its equipment is in better condition than the equipment of the other companies.

THE CHICAGO UNION TRACTION COMPANY is seeking to secure control of the Chicago Railway Company, and only a difference of opinion as to the value of the stock of the company stands in the way of closing the deal. The Traction Company desires a lease of the City Railway lines in precisely the same way it secured the North & West Chicago. It is not the intention to purchase the stock of the City Railway outright, but to guarantee dividends of stock at such a rate as would prove acceptable to the holders of City Railway stock and leave the Chicago Union Traction Company a margin of profit. It is understood that the people interested in the Chicago Union Traction Company are willing to guarantee 14 per cent. upon the capital stock of the company, or 4 per cent. a year on a valuation of $350 a share for the stock. It is said the control of the City Railway could be secured if the traction company would guarantee 4 per cent. a year on a valuation of $400 a share, or 16 per cent. on the present capital. The City Railway Company has paid to stockholders 12 per cent. a year upon a capital stock of $12,000,000. The stock has been increased, however, to $13,000,000, stock having been issued July 1.

WISCONSIN NOTES.

Milwaukee, Wis., July 29, 1899.

MR. FRED GALE, representing the Erie Iron Works, Erie, Pa., has secured the contract for the furnishing and setting up the machinery for the electric light plant at Elroy, Wis. It is thought that the plant completed will cost the city $15,000. Bonds to the amount of $10,000 have been issued.

ELECTRIC LIGHTING IN STEVENS POINT.—It is stated that William Maniland, representing an Eastern syndicate, has purchased the bulk of the Stevens Point Lighting Company's stock. The company will expend $150,000 rebuilding the plant. It has secured an 18-year contract to light the city with at least 65 arc lamps at $78 per year per lamp, to burn every dark hour during that period.

STRIKES.—About 30 men employed in building an extension to the Interurban Railway at Chippewa Falls, went out on a strike on July 21, because a raise in wages of 15 cents per day had been refused them. It is now almost certain that the conductors and motormen on the Interurban will also strike, as the company has ignored their requests for an increase of pay or shorter hours.

INCREASING WAGES.—On and after Aug. 1 every trainman in the employ of the Milwaukee Electric Railway & Light Company who has been with the company for five years will be given an advance in wages of one cent an hour, which at the present scale means 20 cents instead of 19 cents an hour. This rule is in effect not only for the present, but for the future. At present this increase will only affect about 50 men, practically those who stayed with the company through the strike. This step by the company was taken without any request or other action being taken by the employees, and is the result of a desire on the part of the company to retain its faithful employees and to hold out an inducement to them to remain with it.

ST. LOUIS NOTES.

St. Louis, Mo., July 29, 1899.

THE INTEREST of the Fourth Street & Arsenal Railroad Company in the Fourth Street & Arsenal Electric Railroad was sold by the sheriff July 26 to satisfy a judgment for $9,776.44, held by the Laclede Power Company. It was bid in for $680. It is supposed that the bidder represented the Laclede Power Company.

NO FRANCHISE TAX.—The State Board of Equalization at Jefferson City has decided to rescind its action in assessing the franchise and tangible property of the St. Louis & Suburban Railroad of this city. It has been informally decided to increase the assessment of street railway properties. The increase will be about $10,000,000 over last year. St. Louis roads will bear the greater part of this.

A NEW TELEPHONE SERVICE.—Mr. A. B. Sproul, of the Sparta Telephone Company, will go to Belleville to solicit subscriptions for a new telephone system for Belleville. He and his associates will apply for a franchise at the next meeting of the City Council. The company he represents has connections with nearly all the Southern Illinois towns. The expressed intention is to work in connection with the Kinloch Company at St. Louis and East St. Louis.

TAX NOW ON THE FRANCHISE.—The Missouri State Board of Equalization last week increased the valuation of railroad, bridge and telegraph prop-

erty of this State for taxes for 1899 about $15,000,000. Nearly $12,000,000 of this was on street railroad property. Telegraph property was increased $50,000. The total valuation of State property is increased from about $91,000,000 to $105,000,000, and the assessment increases taxes nearly $25,000. The increase of valuation is mainly brought about by the assessment of franchise values.

MISSOURI-EDISON CLUB'S OUTING.—The Missouri-Edison Club, composed of the office employees of the Missouri-Edison Electrical Company, held its annual banquet and election of officers at the Cottage at Forest Park, July 20. Seventy-five members were present. The following officers were elected: P. J. Parker, president; F. Schmidtmann, vice-president; Frank Herbert, secretary; T. S. Clark, treasurer. The old boards of directors and trustees were re-elected. After the business session the company sat down to a fine spread, at which Mr. H. A. Wagner acted as toastmaster. A minstrel show completed the evening's entertainment.

PACIFIC COAST NOTES.

San Francisco, Cal., July 22, 1899.

THE CHILCOOT TRAMWAY, on the Lake route to the Klondike region, has been purchased by the White Pass Railway Company, which now has a monopoly of power transportation over the pass. In the negotiations, Mr. Hugh Wallace represented the Tramway Company and General Manager Hawkins the White Pass Company.

THE YUBA ELECTRIC POWER COMPANY expects to have its line to Sacramento, Cal., completed during August. The distance is 60 miles, and current will be transmitted at 43,000 volts. The company has a long-term contract with the Sacramento Electric, Gas & Railway Company, to furnish a large amount of current to supplement the output of the latter company's plant. The line wire will be of aluminum.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY'S Seattle exchange now boasts the largest number of subscribers in the State of Washington. There are 3067 telephones in Seattle, 1800 in Spokane and 1400 in Tacoma, according to the latest statistics. Mr. F. C. Millard, division superintendent, with headquarters in Seattle, recently said that 250 miles of new lines had been strung in his district within the past year. The lines from Anacortes to Coupeville, on Whidby Island, are completed, there being a span of 700 feet across Deception Pass, Puget Sound. A line to the Republic Mining Camp was recently completed. A new line of aluminum wire has been constructed from Seattle to Snoqualmie, via Renton. A line will soon be completed to Sultan, in the famous Monte Cristo Mining District.

CANADIAN NOTES.

Ottawa, Ont., July 29, 1899.

ELECTRIC POWER IN CAR SHOPS.—The Canada Atlantic Railway Company will, during the coming autumn, commence the erection of large car shops at Ottawa, consisting of wood-working, drying and painting shops, operating them by electricity.

NEW OFFICERS FOR THE ROYAL ELECTRIC COMPANY.—At the recent meeting of the directors of the Royal Electric Company, Mr. Rudolph Forget was elected president, and Lieutenant-Colonel J. A. L. Strathy, vice-president. The election of Mr. Forget is received with general favor by the Street and by the friends of the corporation in question.

RELINQUISHED POWER RIGHTS.—A despatch from Niagara Falls states that the Niagara Falls Power Company has relinquished all its rights on the Canadian side of the river. The company has evidently refused the new agreement that the government offered it, and which it was thought would be accepted. The new agreement deprived the company of a monopoly of the right to generate power, which was the essential feature of the old agreement, to which exception was taken in the legislature of Ontario.

RAILWAY CONSOLIDATION IN MONTREAL.—It is reported that the Montreal electric street railway is about to absorb the Montreal Park & Island Railway. An agreement has not yet been reached, but the Park & Island Company has offered to sell for $800,000. This sum is more than the Montreal company is prepared to pay, but since the fact remains that it is only a question of price which is standing in the way of the closing of the deal, it is not unreasonable to suppose that an agreement will soon be reached.

PRIZES FOR RAILWAY EMPLOYEES.—The Montreal Park & Island Railway has issued a notice stating that after Aug. 1 conductors and motormen who have been in the company's employ for two years or over will be paid 15 cents per hour. There will also be one hundred dollars distributed at Christmas in prizes to the motormen and conductors holding the best records, as follows: For the motorman and conductor, with best record, having worked 350 days or more during the year, $20 each; for the two having worked 200 days, $15 each; for the two having worked 100 days, $10 each, and for the two having worked 60 days, $5 each.

General News.

THE TELEGRAPH AND TELEPHONE.

BATTLE CREEK, MICH.—The Michigan Telephone Company has purchased property here, and will build an exchange.

ROCHESTER, N. Y.—The Lyons Telephone Company is now connected with Lock Berlin, Clyde, Newark, Rose and North Rose.

CHEYENNE, WYO.—The Postal Telegraph Cable Company has been incorporated here with a capital of $50,000. Incorporators: T. B. Hicks, .G Clark, C. W. Riner, all of Cheyenne.

SIOUX CITY, IA.—At a meeting of the Executive Council at Des Moines the decision was reached to assess the Home Telephone Company of Sioux City at $1000 per mile on forty miles of line.

SKAGUAY, ALASKA.—The Dominion Government line telegraph is now completed to Five Fingers, and is advancing so rapidly that in less than two months messages may be sent over it to Dawson.

LEXINGTON, KY.—Mayor Simrall has signed the ordinance which decrees that Lexington shall have two telephone systems, two sets of poles and wires and two instruments in every establishment that desires to keep in touch with all telephone subscribers.

ABERDEEN, S. D.—The Dakota Central Telephone Company has made a deal by which it absorbs the lines of the Midland Telephone Company. These lines extend from Ellendale to Kulm, Ludden, Oakes, La Moure, Edgley, Frederick and intermediate points.

HUNTINGTON, PA.—W. C. Prickett, of Williamsport, soliciting agent for the Central Pennsylvania Telephone & Supply Company, has been making a canvass along the route of the new Broad Top telephone line between this point and Bedford, and is meeting with success.

WARM SPRINGS, VA.—The Bath County Telephone Company has been organized to operate a telephone exchange; capital, $5000. Incorporators: W. M. McAllister, M. H. McClintic, J. W. Harper, J. T. McAllister, all of Warm Springs; M. O. Ferrall, of Mountain Grove.

NEW DECATUR, TENN.—The Southern Bell Telephone Company has been making improvements recently in its service at this place. It will soon put in a separate exchange for this city, as the exchange in Decatur can no longer accommodate the increased business of the two towns.

WILMINGTON, DEL.—A telephone line via Preston, Hurlock and Cambridge will be built from Easton to Seaford, connecting at the latter place with the line of the Diamond State Telephone Company. A line via Cordova, Queen Anne, Hillsboro, Ridgely and Denton will also be built from Easton to Middletown.

ANDERSON, IND.—The Anderson Telephone Company has elected George M. Beers, of Fort Wayne, president; J. J. Netterville, of Anderson, secretary, and George Quick, same city, treasurer. The company has contracted for independent long-distance connection with Ohio, Illinois and Michigan, the exchange to open Oct. 1.

WATERTOWN, N. Y.—The Citizens' Telephone Company has filed articles of incorporation, with a capitalization is $50,000. The general route is in and through the county. The directors are: S. C. Sherman, S. F. Bagg, Robert J. Buck, of Watertown; Robert Bliss, Howard Gallup, Robert S. Monroe, James K. Whitaker, of New York City.

MOBILE, ALA.—At the annual meeting of the stockholders of the Home Telephone Company, the following were elected directors for the ensuing year: A. S. Benn, J. K. Glennon, W. H. Fitzpatrick, Adam Glass, A. S. Lyons, P. J. Lyons, A. H. Spira, O. F. Cawthon and L. C. Fry. The reports of officers showed the company is in fine shape and the stockholders were well pleased with last year's business.

KANSAS CITY, KAN.—On July 29, the property of the Tri-State Telephone Company will be sold at public auction by the receiver of the company in this city. This company was incorporated about eight months ago. It strung its wires from Kansas City, Mo., to Clay Center, Kan., passing through about twenty-six of the best towns in Kansas. The company was incorporated with a capital stock of $100,000.

BLOOMSBURG, PA.—The directors of the Montour & Columbia Telephone Company made arrangements to construct the line this year. The line will connect Danville, Riverside, Catawissa, Bloomsburg and Berwick, and also connect with the Shamokin Valley, Williamsport, Lackawanna and Schuylkill lines. Bloomsburg and Catawissa Counties have given the new company permission to erect lines and poles in each place.

NEWBURG, N. Y.—There is friction between the Western Union Telegraph Company and the Board of Assessors of the town of Fishkill, which has been running three years, and unless healed may result in the removal of the property of the company from the town. For three years the telegraph company has refused to pay the tax levied by the Board of Assessors upon the property of the company in the town. The board has requested the company to meet them, but this request has been refused.

DES MOINES, IA.—General Solicitor Cole, of the American Telephone Company, appeared before the State Executive Council asking a reduction of the company's assessment in Iowa. It now owns long distance lines from New York to Omaha, and he said it will next year build from Davenport to St. Paul, from Des Moines to Minneapolis, and from Council Bluffs to Kansas City, connecting with other important Western cities. It also intends to extend the main line from the Missouri River to the Pacific.

LEXINGTON, KY.—The Lexington Telephone Company has gone right to work in establishing its system in the city and county. The stockholders elected the following officers: President, Desha Breckinridge; secretary and treasurer, John T. Shelby; general manager, J. J. Downey; and the following directors—W. C. P. Breckinridge, John R. Allen, F. A. Bullock, John T. Shelby, J. J. Downey and Desha Breckinridge. Manager Downey was authorized to purchase at once 1000 poles and other material and to secure a suitable location for an exchange. President Breckinridge said that the system would be in operation in two or three months.

GRAND RAPIDS, MICH.—At the annual meeting of the Citizens' Telephone Company, the report of the year's work was read by President Rood, and was very satisfactory to the stockholders, a 2 per cent. cash dividend having been paid quarterly during the year, the same as was done the year preceding The report showed a net growth of 520 subscribers. The number of city subscribers was stated to be 2859 and 649 outside subscribers, making a total of 3508. At the stockholders' meeting the present officers and directors were re-elected. The officers are: President, Charles F. Rood; vice-president, Edward Fitzgerald; secretary, Amos S. Musselman; treasurer, James M. Barnett.

ELECTRIC LIGHT AND POWER.

KANSAS CITY, MO.—The fourth application for an electric light franchise has been filed with the city clerk. The new company is composed of Robert L. Winter, W. H. Weiss, Col. Milton Moore and Robert L. Gregory. It asks for a thirty-year franchise to operate an electric light, heat and power plant.

KNOXVILLE, TENN.—The Knoxville Water & Electric Power Company has been granted a franchise. The company proposes to dam the Holsten River several miles above the city, and supply electric light and power at a much less rate than at present prevails. The company's authorized capital is $1,000,000. It is supposed that New York men are behind the local representatives.

BLOOMINGTON, ILL.—A corporation known as the Bloomington Gas Light & Electric Company has been formed by the consolidation of the Citizens' Gas & Heating Company, the Citizens' Electric Company and the Gridley Gas Works. The capital stock is $400,000. This unites all the lighting plants of Bloomington, with the exception of the Bloomington Electric Company.

COHOES, N. Y.—The new electric light plant of the Cohoes Electric Light Company, near the Champlain Canal, is almost completed, and will soon be in operation. The power will be obtained from the Mohawk. There is a large water wheel which will operate two dynamos, while a smaller one is to be run by another water wheel. The plant is to be auxiliary to the one in the First Ward, and will be used to furnish power to small manufacturing concerns. The larger plant will be used exclusively for lighting purposes.

THE ELECTRIC RAILWAY.

ANNAPOLIS, MD.—The certificate of incorporation of the Kensington Railway & Electric Company, of Montgomery County, has been received at the Executive Department.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has been indicted for using soft coal in its power house at Lenox Avenue and 146th Street. Two other concerns were also indicted.

HARRISBURG, PA.—Attorney-General Elkin has ordered that proceedings be commenced against the Clearfield Traction Company for an alleged illegal issue of bonds to the amount of $750,000.

HUNTSVILLE, ALA.—The Huntsville Railway, Light & Power Company has awarded a contract for 11,000 ties to J. W. Grayson & Son, of Gurley. The ties will be used in the street railway now being built.

STEUBENVILLE, O.—The Mingo Junction Council accepted the bid and passed an ordinance giving the franchise to construct a street railway to Steubenville to Lee and H. S. Sands, William Lipphart, F. H. Eiche, W. H. Hearne and L. G. Hallock, of Wheeling.

DUNKIRK, N. Y.—The Dunkirk & Point Gratiot Traction Company has been incorporated, with a capital of $25,000. Incorporators: J. C. Haggett, L. F. Stearns, W. Bookstaver, G. Richmond, A. W. Cummings, of Dunkirk; S. F. Nixon, of Westfield; F. R. Green, of Fredonia.

FOSTORIA, OHIO.—John J. Geghan has been granted a franchise by the Council of the village of North Baltimore for an electric street railway between North Baltimore and Galatea. The road is to be completed by January next, and the fare is to be limited to ten cents each way.

BUFFALO, N. Y.—Mr. W. Caryl Ely has been elected president of the International Traction Company. Col. Daniel S. Lamont was elected vice-president, R. F. Rankine, secretary, and Burt Van Horn, general manager. The following directors also were elected: C. H. Coster, D. S. Lamont, Francis Lynde Stetson, William B. Rankine, T. Dewitt Cuyler, Burt Van Horn and W. Caryl Ely.

LYNCHBURG, VA.—Col. A. H. Leftwich has purchased seventy-five acres of land in Amherst County, four miles above the city, the purchase carrying with it, according to riparian rights, one-half of the river for a distance of three-eighths of a mile. It is proposed to form a stock company to develop the water power, convey it to the city by electrical transmission, and furnish power for manufacturers, street railways, etc.

PATERSON, N. J.—All of the lines of the Paterson Railway Company, of which Vice-President Garrett A. Hobart is the president, have passed into the hands of the Consolidated Traction Company, controlled by the Shanleys, of Newark, and the new corporation will at once take hold of the lines in this city, which are the East Side Park line, Beech and Clay street line, Cedar Lawn line, Haledon line, Main street and Passaic line and the Central line.

NEWARK, N. J.—The North Jersey Traction Company will soon demolish the old car stables at the corner of Miller Street and Frelinghuysen Avenue, and will erect in its stead a fine plant, to cost nearly $50,000. There is to be a two-story brick administration building, 21x180 feet, with all necessary appointments. The car barn will also be of brick and will be 269x100 feet in dimensions. There will be four pits where car motors may be repaired, and 12 tracks running to them. The plant will be ready for use in the late fall.

NEW YORK, N. Y.—Steps are being taken to consolidate the proposed cross-country railroad from Flushing to Jamaica, and from there to Brooklyn, with the New York & North Shore Railroad, now building a line between Flushing and Jamaica, where a connection will be made with the Long Island Railroad, running from Jamaica to Far Rockaway and from Jamaica to Brooklyn. It is said that the cross-country railroad, the Long Island Electric and the New York & Northern Shore railroads eventually will be consolidated. This would put all the trolley roads in Queens Borough except the branches of the Brooklyn roads under one control.

WINSTED, CONN.—New York capitalists will construct an electric railway for the transportation of freight and passengers between Copake, N. Y., to connect with the Boston & Albany, in West Springfield, Mass., a distance of 67 miles. The company proposes to operate its lines, a 23-mile branch of which will extend from Copake through the Massachusetts towns of Mount Washington, Egemont and Great Barrington, to New Marlborough, thus giving the people of southern Berkshire County a shorter way to New York via the New York Central than by the Berkshire division of the New York, New Haven & Hartford road. Surveys for the new electric road have already been made.

WASHINGTON, D. C.—The change in the motive power on the Columbia Street railway from cable to electric conduit was made on July 23. The cars have been running since that time without interruption. When the cable stopped there remained to be cut away and removed 450 feet of grip guard, and to be put in place 1500 feet of curved conductor rail and special work, there being ten curves on the line. Within six hours the underground construction was completed, the electric insulation tested, the current turned on and the cars started. The work, which was done under the direction of Mr. Theodore J. King, who until the road changed hands recently was the general manager of the company, is looked upon as very skilful engineering, for the reason that not only was it necessary to make the change in the conduits while the road was in service, which was done on the 7th Street line, but machinery for generating electricity was installed in the power house and prepared for use while the machinery for the cable road was still needed. In the case of the 7th Street road the electric power was furnished from another power house than the cable station.

THE AUTOMOBILE.

DOVER, DEL.—Pittsburg and Allegheny capitalists, with $1,000,000 capital, will make automobiles in the name of the United States Motor Company. The company will also make other electrical vehicles.

THE HOWARD H. BROWN AUTOMOBILE COMPANY has been organized in Chicago, with a capital of $100,000, to manufacture automobiles, motors, bicycles, etc. The incorporators are Howard H. Brown, A. L. Kull, Harold A. Smith.

AUTOMOBILE FACTORY.—A despatch states that the Bridgeport Improvement Company of Bridgeport, Conn., has an offer from a large horseless carriage manufacturer from Connecticut. It is offering large inducements to have the company locate there.

MAIL AUTOMOBILES IN TORONTO.—The Postmaster-General has decided to give the automobile a test in the work of collecting letters, and in carrying mail to and from the general post-office in Toronto to the branches. Mr. Mulock has had a sum inserted in the supplementary estimates, and within a short while automobiles will be purchased for use by the Toronto postal authorities.

TRACTOR TRUCK COMPANY.—The Tractor Truck Company has been incorporated at Trenton, N. J., with a capital stock of $2,500,000. Of this amount $1,000,000 is to be in preferred stock bearing 7 per cent. non-cumulative dividends. The company is to operate automobiles for the carrying of passengers, freight and express matter. The incorporators are T. Henry Dixon, J. Bausall Taylor, C. Berkeley Taylor and George H. B. Martin.

AUTOMOBILES IN MEXICO.—A company, composed of Chicago and Mexican capitalists, is being formed for the purpose of establishing an automobile service in the City of Mexico. It is understood that an effort will be made by the company to obtain an exclusive concession for the operation of automobiles in that city for a long term of years from the Mexican government, but it is doubtful if such a valuable privilege will be granted.

AUTOMOBILES IN BUFFALO'S PARKS.—The city of Buffalo has made a contract with the National Motor Transit Company for the operation of automobiles in the city parks. The city gives the company a one-year franchise for the nominal sum of $1. The company may charge five cents for a single trip. The company assumes all liability from accidents arising from frightened horses. The carriages must not run at a greater speed than eight miles an hour, and their design must be approved by the park board. The company will first try gasoline carriages and may change to electric vehicles later on.

AN AUTOMOBILE EXPRESS WAGON, ordered of the Fischer Equipment Company, of Chicago, by the United States Express Company, in New York, will soon be delivered. The wagon marks a new departure in the express business. The weight of the vehicle is 2500 pounds, and it will cost $2000. It is built to carry two men and a dead weight of 800 pounds. It is said to have made a speed test of twelve miles an hour, and has made a continuous run of forty-seven miles on one charge. The wagon is lighted by electricity, and on either side of it is a plate-glass illuminated sign. It is painted a bright red. If the new wagon proves a success a large number will be ordered.

AN AUTOMOBILE RACE took place at Belmont Driving Park, Philadelphia, on July 28. There were three entries—a Winton hydrocarbon vehicle, a vehicle of the General Automobile Company and a Waverly, made by the Indiana Bicycle Company. Each vehicle weighed 2300 pounds. The Indiana Waverly vehicle punctured one of its tires on the road to the track, and although it completed the two-mile course, did so not with any hope of winning, but rather to fill the class. The Winton led from the start, and passed under the wire at the end of the second mile about ten feet ahead of the General automobile vehicle. The time reported by the judge was 7m. 38¼s.

DAIMLER AUTOMOBILE FACTORY.—The new automobile plant of the Daimler Manufacturing Company, at Steinway, in the Borough of Queens, N. Y,. is well under way, and it is expeced that the machine shops will be ready in less than a yea1, so that all of the various parts of the self-propelling vehicles can be made at the factory. Adolph O. Krieger, secretary of the Daimler Manufacturing Company, says that the Whitney interests are now backing the venture, and the Daimler Manufacturing Company, which is capitalized at $500,000, and has for some time been making motors, will take steps toward reincorporation as an automobile company, with a capital stock several times larger than the present capitalization. It is also thought that some connection may be developed between the new company and the Astoria Light, Heat & Power Company. Rudolph E. F. Flinsch, who is to be at the head of the new automobile concern, has gone abroad on a business trip, and upon his return the organization plans will be still further developed.

PERSONAL.

PROF. F. B. CROCKER, who has been making a tour around the world, and has spent the last month or two in France and England, left for New York from Southampton by the St. Louis on July 29.

MR. F. J. SPRAGUE and Mr. Robert Lundell, of the Sprague Electric Co., have gone to Europe for a holiday vacation. It is curious how many of these trips result in important new enterprises on the other side.

PROF. A. E. DOLBEAR has a paper in the August number of *The Coming Age* entitled "The Kind of Universe We Live in," and discusses in a brilliant manner the results of discoveries made through the telescope, spectroscope and microscope.

MR. C. L. ROSSITER, president of the Brooklyn Rapid Transit system, having denied that he charged Mr. A. L. Johnson with complicity in the recent dynamite outrages in connection with the trolley strike, the suit for criminal libel against him has been dropped, as was expected.

MR. J. K. BAYLOR, of the British Thomson-Houston Company, is on this side visiting his home, and enjoying a brief vacation. He speaks very hopefully of the traction situation in England, and foresees a splendid trolley development there. He will spend about six weeks here.

MR. W. H. MEADOWCROFT.—After eighteen and a half years' connection with the General Electric Co. and its predecessors, Mr. William H. Meadowcroft has tendered his resignation, which takes effect on August 5. He has accepted the position of general manager of the Perret Storage Battery Company, of this city.

MR. W. BUCHANAN, of the Electric Construction Company, Limited, of Wolverhampton, England, and Mr. H. Dickinson, engineer and manager of the City of Leeds electric lighting department, arrived in this country last week on a trip of four or five weeks, to be devoted chiefly to an inspection of phase work and plants. They will go as far west as Chicago.

A POLLOK MEMORIAL.—Among those who were lost at sea in the Bourgogne disaster were Mr. Anthony Pollok, the well-known Bell telephone patent attorney, and his wife. They had no children, and their wealth was inherited by their nieces. These announce that they have decided to create a monument to the memory of the drowned ones. They will offer a prize of $20,000 to the inventor of the best device for saving life at sea. The proposition is made to the State Department through Ferdinand Peck, the Commissioner General of the United States to the Paris Exposition, and the competition will be under American auspices. The ladies who make the offer are Mme. Gustav Paraf, Mme. Gustav Richelot and Mme. George Ostheimer, who live in Paris. Mr. Pollok was the senior member of the firm of Pollok & Mauro, patent attorneys, of Washington. He was born in Hungary, and was a graduate of the Ecole Centrale, the famous scientific school in Paris. He studied civil engineering and then law, afterward going in for the patent branch. His work on the telephone and graphophone are familiar to those in electrical circles.

HENRY HINE.

MR. HENRY HINE.—Anyone at all familiar with the commercial development of the electrical business in the United States, has been impressed with the fact that there are a few men who tower head and shoulders above the crowd, as organizers and managers; and who have made rapid and remarkable successes by reason of unusual talents in the difficult commercial end of the electrical business. Size, influence and opportunities considered, one of the conspicuous successes has been that of the Stanley Electric Manufacturing Co., of Pittsfield, Mass. Starting in a limited way with small capital, no "pull," and building up its business in eight years to a point where it to-day stands at the head of its special line of manufacture, even in the face of the most strenuous competition, its record is one to be proud of, and reflects the greatest credit upon Mr. Henry Hine, its general manager. Mr. Hine is the man who defined the policy and whose conservative but vigorous management placed this company so far in front. As stated in our issue some weeks ago, Mr. Hine has also been appointed the general manager of the Sprague Electric Company. He is so well known that it is not necessary for us to give any further details of his rapid rise to prominence than were then given. We feel, however, that the Sprague Company are to be congratulated upon having the management of their business fall into such able hands, and we feel sure that they will soon become a much more prominent factor in the electrical field even than at any time heretofore. Mr. Hine now has to spend a great deal of his time in New York, so numerous are the claims upon his energies and attention.

Trade and Industrial Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is sending out some mailing cards describing the Noxal annunciator, which has become popular in its territory.

THE McKENZIE FURNACE COMPANY, Chicago, has secured an order for one of its traveling grates and mechanical stokers from the Toledo Company, Toledo, O.

THE ELECTRICAL EQUIPMENT COMPANY, Pittsfield, Mass., will open a store in the Wheldon Block, about Aug. 1. The company will carry a full line of electrical goods, and will do all kinds of electrical work. It will be pleased to hear from supply houses.

THE CENTRAL ELECTRIC COMPANY, Chicago, is maintaining a Chicago stock of the Edison screw base sockets with fiber lining. These conform to the rules of the National Board of Fire Underwriters, which went into effect on July 1.

WOOD SYSTEMS.—The Fort Wayne Works (Inc.), Fort Wayne, Ind., in Bulletin No. 1001, just issued, describes direct-current, direct-connected generators for light and power. These generators are of the multipolar type, and are made in six sizes, ranging from 15 to 130 kilowatts.

THE RHODE ISLAND ELECTRICAL WORKS have been organized at Saco, for the purpose of manufacturing and dealing in electrical apparatus, with $125,000 capital stock. The officers are: President, John Roth, of Central Falls, R. I.; treasurer, Charles D. Wood, of Central Falls, R. I.

STORAGE BATTERIES IN ISOLATED PLANTS.—The Electric Storage Battery Company, 19th street and Allegheny avenue, Philadelphia, Pa., in its bulletin No. 52, describes and illustrates the installation of chloride accumulators in the factory building of Jones Brothers, Brooklyn, New York.

MESSRS. A. L. IDE & SONS, Springfield, Ill., have filed a suit against the Trorlicht, Duncker & Renard Carpet Company, Joseph F. Chuse and Richard Heap. The complainants allege that defendants are infringing their patent on improvements in lubricating devices for engines, and ask that defendants be enjoined.

WESTINGHOUSE BULLETINS.—The Westinghouse Electric and Manufacturing Company has just issued two bulletins— Nos. 229 and 231. The former relates to belt driven railway generators, and the latter to switches of the adjustable jaw types for potentials not exceeding 600 volts. Both bulletins contain illustrations of the apparatus described.

OLD STYLE IRON CLAD INSULATORS.—In a recent number we published an inquiry from Mr. W. M. Lanman, as to the possibility of purchasing the "old style iron clad insulator." Mr. H. C. Spaulding, of Boston, writes us that in the catalogue of electrical supplies published by the H. W. Johns Manufacturing Company, these insulators will be found among other types made by that concern.

THE GOLD CAR HEATING COMPANY and the Gold Street Car Heating Company report that the number of orders which have been taken during the past few months are of such magnitude as to surpass all former records of the companies. Prominent among the recent orders for electric heaters is one from the Boston Elevated Railway Company, formerly the West End Street Railway Company, of Boston, which has awarded the contract for electric heaters for one hundred new cars, to the Gold Car Heating Company.

MESSRS. CHARLES H. BESLY & CO., 10 and 12 North Canal street, Chicago, Ill., report numerous shipments of their Helmet oil and Perfection and Bonanza oil cups throughout the agricultural districts, extending from Maine to California. They state that they have never experienced so large a demand for this lubricant as at the present time. Among foreign orders they are just equipping a machine shop in India with lathes, drill presses, chucks, fine tools, etc. Their new 1899 catalogue is now ready for distribution

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, reports that its spring and summer business has been exceptionally good, especially so in the sales of the Moloney transformer. This transformer is one of the most serviceable on the market, embodying all the most desirable features of economic distribution which experience has thus far suggested in the construction of transformers. It is said that it has never been defeated in any competitive tests. The regulation is extremely close, and its mechanical construction is perfect. These transformers are guaranteed for two years, and in every instance where they have been installed, are said to have given complete satisfaction.

RESISTANCE WIRES.—Messrs. Wilbur B. Driver & Co., 126 Liberty street, New York, have issued a booklet giving data and prices of Climax, Advance and "D" resistance wires. Climax resistance wire is said to have a high specific resistance, and possesses great strength and toughness. It has 48 times the resistance of copper, and its mechanical properties make it available for rheostat work. Advance wire has about 30 times the resistance of copper, and a temperature coefficient that is practically nil. It is especially recommended for measuring instruments. "D" wire has a resistance about 17 times that of copper. It is stronger than German silver wire, will not corrode so quickly, and has a lower temperature coefficient.

MESSRS. BRYAN & HUMPHREY, consulting mechanical and electrical engineers, St. Louis, Mo., report a very active season. The original installation of 2500-hp for the Imperial central station at 10th and St. Charles streets, St. Louis, Mo., is about completed, and an addition of 1500-hp of engines, generators and boilers is being installed, and is expected to be in service by Oct. 1. The firm is installing an isolated electric lighting plant and electric elevators in the Nugent dry goods store. They have also contracted for electric elevators for the new Lindell and Boyle buildings, on Washington avenue. Their out-of-town work includes a central station at El Paso, Tex.; a 500-hp boiler plant for the State Lunatic Asylum at St. Joseph, Mo.; a 1200 light isolated lighting plant for the State Lunatic Asylum at Nevada, Mo., and an electric pumping station at White Hall, Ill. They also have in hand considerable work of less importance covering a wide field of engineering.

PRIVATE LIGHT AND POWER INSTALLATIONS.—An artistically prepared book has been issued by Messrs. Westinghouse, Church, Kerr & Co., New York, entitled "Light and Power Installations for Private Residences and Hotels." The finest tinted paper, profuse and original illustrations and a choice blending of colors, combine to present a business publication in a luxurious setting, coupled with the most refined good taste. The pages are illustrated with artistic views of private residences and hotels where electric lighting is provided by Westinghouse gas engines and generators. The Westinghouse gas engine is specially adapted for electric lighting. Gasoline can be used as fuel when gas is not available. With an electric plant, light is supplied for the house, stables and grounds; and also power for operating pumps, elevator service, ventilating fans, lathes, saws, preparing fodder, ice freezers, dairy, laundry and other work connected with private residences and hotels.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JULY 25, 1899.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

629,325. SECONDARY BATTERY; Ralph Ashley, of Port Republic, N. J. App. filed Aug. 29, 1898. (See Current News and Notes.)

629,340. ELECTRIC HAIR BRUSH; A. J. Cook, Jersey City, N. J. App. filed April 11, 1899. A battery and induction coil is fixed to the back of the brush, and the handle contains a circuit closer. The bristles of the brush are divided into groups for connection into the secondary circuit of the coil.

629,363. ACCUMULATOR PLATE; Henrich Franz Hobel, of Berlin, Germany. App. filed Jan. 31, 1899. (See Current News and Notes.)

629,371-2. STORAGE BATTERY; Charles W. Kennedy, of Rutledge, Pa. App. filed Aug. 29, 1898. (See Current News and Notes.)

629,373. COVERING FOR JUNCTION BOXES; E. Kern and C. Claflin, New York, N. Y. App. filed Oct. 12, 1898. A junction box adapted to be set into the wall, having an opening for the connection of the conduit and the entrance of the wires, a cover therefor with an opening for the passage of the wires leading to the lamps and a fixture supporting piece secured to the cover and insulated therefrom.

629,397. AUTOMATIC MAGNETIC CIRCUIT BREAKER; W. M. Scott, Philadelphia, Pa. App. filed Jan. 28, 1899. The circuit controlling lever normally remains in the closed position by friction with the contacts and the magnet releases a trip which in turn allows a spring to open and strike the controlling lever and blow to open the circuit.

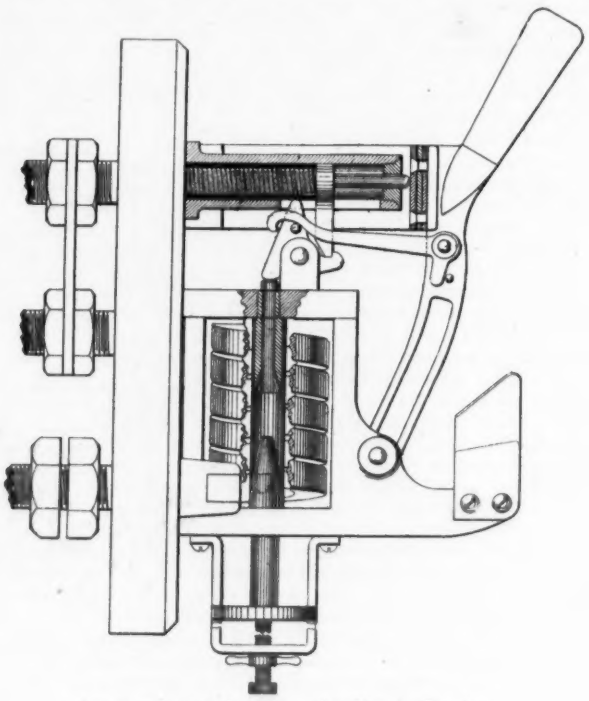
629,398. CONTROLLER FOR ELECTRIC MOTOR CARS OR VEHICLES; Sidney H. Short, of Cleveland, O. App. filed March 2, 1895, and April 25, 1896. (See abstract on page 188.)

629,406. ADJUSTABLE HANGER FOR INCANDESCENT LAMPS; W. N. Fork and F. G. Normark, Fresno, Cal. App. filed Aug. 12, 1898. The flexible conductors are wound upon a spring actuated reel; lowering the lamp winds up the spring, the power of which will raise the lamp when it is permitted to do so by the releasing of the retaining latches.

629,418. BRUSH HOLDER SUPPORT; R. N. Baylis, Englewood, N. J. App. filed May 18, 1899. For the sake of economy of space and ease of manipulation the adjusting devices for the brush project through the brush housing where they can be easily reached.

629,424. ARC LAMP; E. M. Cashion, Glens Falls, N. Y. App. filed Aug. 29, 1898. The inventor claims that the life of the carbons is increased by permitting a current of air to pass through the arc enclosing globe, and for this purpose certain openings are arranged in the top and bottom of the globe.

629,435. THIRD RAIL ELECTRIC RAILWAY SYSTEM; J. R. Farmer, St. Louis, Mo. App. filed Dec. 23, 1899. The third rail is in the shape of an inverted U; it rests upon a string piece from which it is suitably insulated. The trolley is double, taking current from both legs of the U rail.

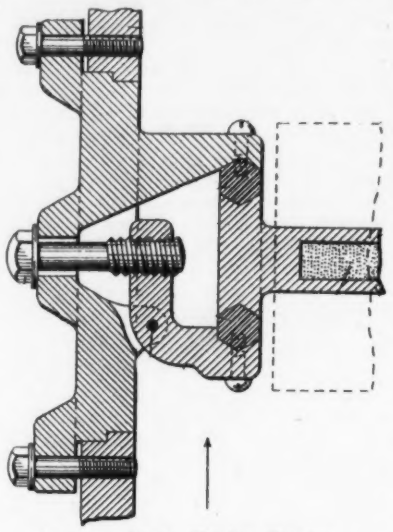


629,397.—Automatic Magnetic Circuit Breaker.

629,445. PLUG RECEPTACLE FOR ELECTRIC CIRCUITS; J. T. Hunt, New York. App. filed Aug. 12, 1898. The receptacle is at all times flush with the surface of the floor or wall whether the plug is within or without the receptacle, and when the plug is within the receptacle, hinged doors effectually conceal the mouth and also said plug, with the exception of the edges of a tubular projection of the plug through which the conducting wires extend and which protect said wires from abrasive or other contact with the adjacent edges of the doors.

629,508. INSULATED CONDUCTOR; J. M. Keller, Newton, Mass. App. filed Sept. 7, 1898. The wire is wound with a tape between which and the wire are interposed small bits of cork which separate the two members from each other.

629,568. RAILWAY; T. J. King and C. O. Babendreier, Washington, D. C. App. filed April 8, 1899. The opening through which the under contact trolley passes to reach its proper position in the conduit is closed by two pivoted lips normally tending to remain closed, and a suitable arrangement of levers is provided for temporarily throwing them apart for the removal or insertion of the plough or trolley.



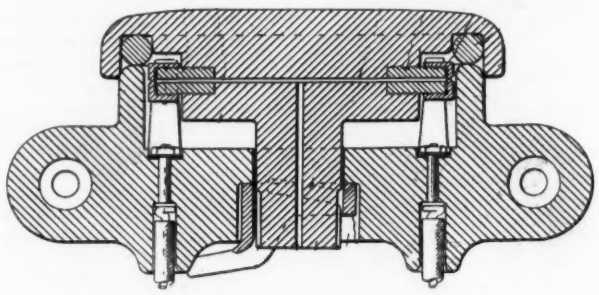
629,418.— Brush Holder Support.

629,584. STATION POTENTIAL INDICATOR; Ralph D. Mershon, of New York, N. Y. App. filed Feb. 1, 1899. (See Current News and Notes.)

629,603. ELECTRIC ARC LAMP; P. J. Queissier, Charlottenberg, Germany. App. filed Sept. 19, 1898. An adjustable device is interposed between the feeding mechanism and the dash pot whereby the feeding mechanism is relieved of the braking influence of the dash pot when the arc is in its normal condition.

629,624. ELECTRICAL SIGNAL; W. H. Stillwell, Topeka, Kan. App. filed May 17, 1898. To prevent the engineer of a locomotive from forgetting certain written orders that may be in his possession, to be observed at a certain point on the road; the said orders are used to separate a pair of contacts which, when a mechanical circuit closer is operated by means of a track device, will cause an alarm to be sounded to remind the engineer of the orders. In case of the absence of orders no alarm will be sounded by the track device alone.

629,631. ELECTRIC HEADLIGHT LAMP; H. P. Wellmann, Ashland, Ky. App. filed April 6, 1899. The lamp is adapted for alternating currents. A primary coil is permanently mounted on the dashboard or the front of



629,663.—Fuse Block for Electric Circuits.

the car or locomotive, while the secondary coil is a part of the lamp structure, the two coils being brought into working position by the proper adjustment of the lamp to the car.

629,638. ELECTRIC DOOR OPENER; A. F. T. Wiechers, New York, N. Y. App. filed Sept. 15, 1898. This is a device whereby a person before leaving the building may set the circuit so that on returning he can, by properly manipulating an outside circuit controlling device, gain admittance without the help of persons inside.

629,663. FUSE BLOCK FOR ELECTRIC CIRCUITS; H. Davis, Pittsburg, Pa. App. filed March 29, 1899. The block comprises two separable parts, one of which is provided with circuit terminals and an opening, and the other with a fuse and fuse terminals and a projection having a blow-out passage and fitting in and extending through said openings in the first part; a suitable clamping device holds the two parts together.

629,664. HIGH TENSION CIRCUIT BREAKER; H. P. Davis and G. Wright, Wilkinsburg, Pa. App. filed March 23, 1899. The circuit-breaker is provided with two sets of contacts, one being carbon and the other metallic. Devices are provided for swinging the carbon contacts into engagement first and thereafter bringing the metallic or main contacts into engagement.

629,665. CONTROLLER FOR ELECTRIC MOTORS; Harry P. Davis, of Wilkinsburg, Pa. App. filed March 29, 1899. (See Current News and Notes.)

629,682. CONDENSER; Peter Cooper Hewitt, of New York, N. Y. App. filed June 1, 1897. (See Current News and Notes.)